

CORRECTED VERSION

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
8 January 2004 (08.01.2004)

PCT

(10) International Publication Number  
**WO 2004/002415 A2**

(51) International Patent Classification<sup>7</sup>:

**A61K**

CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(21) International Application Number:

PCT/US2003/020322

(22) International Filing Date: 27 June 2003 (27.06.2003)

(25) Filing Language:

English

(84) **Designated States (regional):** ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(26) Publication Language:

English

(30) Priority Data:

60/392,718 27 June 2002 (27.06.2002) US

**Published:**

— without international search report and to be republished upon receipt of that report

(71) Applicant (for all designated States except US):  
**DANA-FARBER CANCER INSTITUTE, INC.**  
[US/US]; 44 Binney Street, Boston, MA 02115 (US).

(48) Date of publication of this corrected version:

3 June 2004

(72) Inventors; and

(75) Inventors/Applicants (for US only): **RUPRECHT, Ruth, M.** [US/US]; 127 Winthrop Road, #6, Brookline, MA 02445 (US). **JIANG, Shisong** [CN/US]; 1862B Beacon Street, Apt. 1, Brookline, MA 02445 (US).

(15) Information about Correction:

see PCT Gazette No. 23/2004 of 3 June 2004, Section II

(74) Agents: **SMITH, DeAnn, F.** et al.; Lahive & Cockfield, LLP, 28 State Street, Boston, MA 02109 (US).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,

WO 2004/002415 A2

(54) Title: COMPOSITIONS AND METHODS FOR MODULATING A CYTOTOXIC T LYMPHOCYTE IMMUNE RESPONSE

(57) Abstract: The present invention provides compositions and methods for the treatment and prevention of immune disorders.

## COMPOSITIONS AND METHODS FOR MODULATING A CYTOTOXIC T LYMPHOCYTE IMMUNE RESPONSE

### Related Applications

5

This application claims the benefit of U.S. Provisional Application Serial No. 60/392,718, filed June 27, 2002, the entire contents of which are incorporated herein by this reference.

### 10 Background of the Invention

The initiation of an immune response against a specific antigen in mammals is brought about by the presentation of that antigen to T lymphocytes. An antigen is presented to T lymphocytes in the context of a major histocompatibility (MHC) complex (also referred to as HLA in humans and H-2 in mice). The three-dimensional structure of the MHC includes a groove or cleft into which the presented antigen fits. When an appropriate receptor on a T lymphocyte interacts with the MHC/antigen complex on an APC in the presence of necessary co-stimulatory signals, the T lymphocyte is stimulated, triggering various aspects of the well characterized cascade 15 of immune system activation events, including induction of cytotoxic T lymphocyte (CTL) function; induction of B lymphocyte function and stimulation of cytokine production (see, e.g. Roitt, I and Delves, P. Roitt's Essential Immunology, 10<sup>th</sup> Ed., Boston, Blackwell Science, 2002; Abbas, A. *et al.* Cellular and Molecular Immunology, W.B. Saunders Company, Philadelphia, 1991; Silverstein, A. A History 20 of Immunology, San Diego, Academic Press, 1989).

There are two basic classes of MHC molecules in mammals, MHC Class I and MHC Class II. Both classes are large complexes formed by association of two separate proteins. MHC Class I molecules present antigen to CD8-positive T lymphocytes, which then become activated and can kill the antigen presenting cell 25 directly. Class I MHC molecules generally receive peptides from endogenously synthesized proteins, such as an infectious virus, in the endoplasmic reticulum at around the time of their synthesis (see, e.g., Williams, A. *et al.* (2002) *Tissue Antigens* 59:3; Konig, R. (2002) *Curr. Opin. Immunol.* 14:75; Anfossi, N. *et al.* (2001) *Immunol. Rev.* 14:75; Gao G. and Jakobsen B (2000) *Immunol. Today* 21:630; Watts,

C and Powis, S. (1999) *Rev. Immunogenet.* 1:60 and Natarajan, K. *et al.* (1999) *Rev. Immunogenet.* 1:32).

MHC Class II molecules present antigen to CD4-positive T helper lymphocytes (Th cells). Once activated, Th cells contribute to the activation of CTLs and B lymphocytes via physical contact and cytokine release. Unlike MHC Class I molecules, MHC class II molecules bind exogenous antigens which have been internalized via non-specific or specific endocytosis. Around the time of synthesis, MHC Class II molecules are blocked from binding endogenous antigen, and instead bind the invariant chain protein (Ii). These MHC Class II-Ii protein complexes are transported from the endoplasmic reticulum to a post-Golgi compartment where Ii is released by proteolysis and exogenous antigenic peptides are bound (see, e.g., Villadangos, J. (2001) *Mol. Immunol.* 38:329; Alfonso, C. and Karlsson, L. (2000) *Ann. Rev. Immunol.* 18:113; Viret, C. and Janeway Jr., C. (1999) *Rev. Immunogenet.* 1:91; Diabata *et al.* (1994) *Molecular Immunology* 31:255 and Xu *et al.* (1994) *Molecular Immunology* 31:723).

MHC Class I and MHC Class II molecules have a distinct distribution among cells. Almost all nucleated cells express MHC Class I molecules, although the level of expression varies between cell types. Cells of the immune system express abundant MHC Class I on their surfaces, while liver cells express relatively low levels. Non-nucleated cells express little or no MHC Class I. MHC Class II molecules are highly expressed on B lymphocytes, dendritic cells and macrophages, but not on other tissue cells. However, many other cell types can be induced to express MHC Class II molecules by exposure to cytokines (see, e.g. Roitt, I and Delves, P. Roitt's Essential Immunology, 10<sup>th</sup> Ed., Boston, Blackwell Science, 2002; Abbas, A. *et al.* Cellular and Molecular Immunology, W.B. Saunders Company, Philadelphia, 1991; Silverstein, A. A History of Immunology, San Diego, Academic Press, 1989).

Cytotoxic T lymphocytes (CTLs) are restricted in their activity by recognizing a specific histocompatibility complex (MHC) antigen on the surface of the target cell, as well as a peptide bound in a cleft of the MHC antigen. The foreign antigen may be present as a result of transplantation from an allogeneic host, viral or bacterial infection, mutation, neoplasia, or the like. The involvement of the MHC protein appears to be essential to the attack by CTLs against the cell which includes the

foreign antigen. By monitoring the presence of foreign antigens, the CTLs are able to destroy cells, which if otherwise allowed to proliferate, might result in the proliferation of pathogens or neoplastic cells (see, *e.g.* Roitt, I and Delves, P. Roitt's Essential Immunology, 10<sup>th</sup> Ed., Boston, Blackwell Science, 2002; Rhodes, D. and 5 Trowsdale, J. (1999) Rev. Immunogenet. 1:21; and Yu, C. (1998) Exp. Clin. Immunogenet. 15:213).

The unique capability of CTLs to kill infected and/or cancerous cells has led researchers to try and develop strategies for using CTLs in the designing of vaccines for the treatment of diseases, *i.e.* pathogenic infections and cancer. However, 10 vaccines of killed pathogens or soluble proteins are not effective in the induction of the CTL response. Moreover, naked DNA, live vectors and attenuated viruses, which are effective CTL inducers, are genetic material and potentially pose a serious health hazard, especially in the case of viruses such as human immunodeficiency virus (HIV) and Ebola virus (see, *e.g.*, Baba, T. *et al.* (1999) *Nat. Med.* 5:194).

15 This problem was thought to be solved with the finding that specific T-cell epitopes could be synthetically designed and produced. Townsend *et al.* demonstrated that epitopes of influenza nucleoprotein could be defined by short synthetic peptides and thus included in potential vaccine candidates (Townsend, A. *et al.* (1986) *Nature* 324:575). However, success using synthetic peptides has been limited. Documented 20 cases that describe the use of synthetic peptides, relating to influenza, Sendai and lymphocyte choriomeningitis viruses, for use in the *in vivo* priming of CTLs have presented many problems (see, *e.g.*, Kast, W. *et al.*, (1991) *Immunol. Lett.* 30:229; Aichele, P. *et al.*, (1990) *J. Exp. Med.* 171:1815; Deres, K. *et al.* (1989) *Nature* 342:561). In each of the above cases, the immunization protocols proved to be 25 cumbersome, requiring either modifications of peptides or multiple immunizations to demonstrate CTL activity, and difficulty in rapidly screening large numbers of candidate substances.

Moreover, the use of single epitopic peptides has been shown to only generate 30 CTL responses in a small group of individuals, *i.e.* those individuals who have matched MHC antigens, thus decreasing the effectiveness and usefulness of the vaccine. Although the use of multiple epitopic peptides has been shown to increase the size of the population who will benefit from the vaccine (Hanke, T and McMichael, A. (2000) *Nat. Med.* 6:951), it remains difficult and labor intensive to

accurately predict from a sequence of an antigenic protein how the protein will be processed and which peptide portions will bind HLA class I molecules and be presented to CTLs.

The present invention provides an effective method of modulating, *e.g.*,  
5 inducing, an immune response, *e.g.*, a CTL-mediated immune response, which avoids may of the problems associated with the previously suggested methods. Specifically, the present invention allows for the development of vaccines that are capable of inducing antigen-specific immune responses in subjects of varying genetic backgrounds without the labor intensive task of determining immunostimulatory  
10 epitopes.

### Summary of the Invention

The present invention provides, at least in part, methods and compositions for  
15 the treatment of immune disorders, such as, for example, viral, bacterial and parasitic infections, prion diseases, neoplastic diseases and protection against toxins. The invention is based on the discovery that overlapping synthetic peptide formulations (OSPFs) of the present invention are able to modulate, *e.g.*, induce, immune responses, such as cytotoxic T lymphocyte (CTL)-mediated response and antibody-  
20 associated immune responses, thus indicating a wide applicability for human and veterinary applications.

Accordingly, the present invention provides a method of modulating, *e.g.* inducing, an immune response by administering to a subject, *e.g.*, a vertebrate, such as a human, an effective amount of an OSPF. The OSPF of the present invention  
25 includes a combination of single chain peptides that correspond to an amino acid sequence of a protein of interest, such that the single chain peptide is a length represented by Y, wherein Y is at least 7 to (X-1), and X represents the number of amino acids of the protein of interest, where at least 1 single chain peptide overlaps with another single chain peptide by a length represented by Z, wherein Z is 1 to (Y-  
30 1), such that the length of the single chain peptide is able to be internalized by, *e.g.*, phagocytosis, receptor-mediated endocytosis, and the like, by a MHC bearing cell, *i.e.*, a MHC class I- or MHC class II-bearing cell, and be presented by an MHC molecule to a T cell.

In another embodiment, the OSPFs of the present invention are not overlapping, but instead are adjoining. Therefore, in this embodiment, the OSPF of the present invention includes a combination of single chain peptides that correspond to an amino acid sequence of a protein of interest, such that the single chain peptide is 5 a length represented by Y, wherein Y is at least 7 to (X-1) and X represents the number of amino acids of the protein of interest, such that the length of the single chain peptide is able to be internalized, *e.g.*, phagocytosis, receptor-mediated endocytosis, and the like, by a MHC-bearing cell, *i.e.* a MHC Class I- or MHC Class II-bearing cell, and be presented by an MHC molecule to a T cell.

10 In one embodiment, the immune response is a Th1-mediated immune response, such as a CTL-mediated immune response. In another embodiment, the immune response is a Th2-mediated immune response, such as an antibody-associated immune response.

15 In one embodiment, Y is at least 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, or 30 amino acids.

20 In another embodiment, Z is at least 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, or 29 amino acids.

25 In other aspects, the invention pertains to a method of treating or preventing an OSPF-associated disorder in a subject. The method includes administering to the subject an effective amount of an OSPF of the present invention, thereby treating or preventing the OSPF-associated disorder in the subject. By “OSPF-associated disorder” is meant any disease, disorder or condition which can be treated or prevented through the modulation of an immune response. Examples of OSPF-associated disorders include, but is not limited to, viral infections due to viruses (*e.g.*, Ebola virus, hepatitis C, HIV, *e.g.*, HIV-1 and HIV-2, RSV, monkeypox, and SARS coronavirus, bacterial infections due to bacteria (*e.g.*, anthrax, Listeria monocytogenes, Legionella and mycobacterium such as tuberculosis), parasitic infections (*e.g.* malaria), protection against toxins (*e.g.*, shigella toxin, toxin botulinum and tetanus toxin), parasitic infections due to parasites (*e.g.*, Plasmodium, Trypanosoma, Schistosoma and Toxoplasmosis), prions and neoplastic diseases (*e.g.*, breast, colon, non-small cell lung, head and neck, colorectal, lung, prostate, ovary, renal, melanoma, gastrointestinal (*e.g.*, pancreatic and stomach) cancer and osteogenic sarcoma).

In yet another embodiment, the protein of interest can be any protein associated with an OSPF-associated disorder, including, but not limited to, HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218);  
5 HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); S. aureus enterotoxin A (SEQ ID NO:226); E. coli enterotoxin A (SEQ ID NO:227); C. difficile enterotoxin A (SEQ ID NO:228); B. cereus enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ ID NO:230) ); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid/protein (SEQ ID NO: 234); and SARS coronavirus  
10 (Frankfurt 1) spike protein S (SEQ ID NO: 235). For example, OSPFs for HIV-1 Gag include the peptides set forth as SEQ ID NO:1-122 and/or SEQ ID NO:236-335 and OSPFs for SIV Envelope protein include the peptides set forth as SEQ ID NO:123-206 and/or 336-338.

In another aspect, the invention provides a vaccine for immunizing a subject against an OSPF-associated disorder, wherein the vaccine comprises an OSPF of the present invention and a pharmaceutically-acceptable carrier. In another aspect, the invention provides a pharmaceutical composition comprising an OSPF of the present invention and a pharmaceutically acceptable carrier. In yet another aspect, the invention features a kit for immunizing a subject against an OSPF-associated disorder, 25 wherein the kit comprises an OSPF of the present invention and may further comprise instructions for use.  
30

In yet another aspect, the invention features a vaccine adjuvant which comprises an OSPF of the present invention and a pharmaceutically acceptable carrier which may be used to enhance the efficacy of a vaccine.

5    **Brief Description of the Drawings**

*Figures 1a - 1c* are graphs depicting the CTL activity induced by OSPF-HIV Gag in BALB/c and C57BL/6 mice.

10   *Figures 2a and 2b* are graphs depicting T cell proliferation induced by OSPF-HIV Gag in BALB/c and C57BL/6 mice

*Figures 3a and 3b* are graphs depicting the CTL activity induced by OSPF-SIV *ex vivo* by human dendritic cells and autologous PBMCs, as assessed by ELISPOT<sup>TM</sup> and <sup>51</sup>Cr release assays, respectively.

15   **Detailed Description of the Invention**

***Definitions***

Before further description of the present invention, and in order that the invention may be more readily understood, certain terms are first defined and  
20   collected here for convenience.

The term “overlapping synthetic peptide formulation” or “OSPF” refers to a combination of single chain peptides which correspond to an amino acid sequence of a protein of interest, represented by Y, wherein Y is at least 7 to (X-1) and X represents the number of amino acids of the protein interest where at least 1 single  
25   chain peptide overlaps with another single chain peptide by a length represented by Z, wherein Z is 1 to (Y-1). The length of the single chain peptide must be such that internalization, *e.g.*, phagocytosis, receptor-mediated endocytosis, and the like, of the single chain peptide by a MHC-bearing cell, *i.e.* a MHC-Class I- or MHC Class II-bearing cell, can occur. Preferably, the cell is a MHC Class I-bearing cell.

30   Furthermore, the OSPF must be of a length to allow presentation by a MHC molecule to a T cell. In certain embodiments, Y is at least 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29 or 30 amino acids in length. In other

embodiments, the length of Z is at least 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28 or 29 amino acids.

In another embodiment of the invention, the OSPF refers to a combination of single chain peptides that correspond to a protein of interest and are represented by Y, 5 wherein Y is 1 to (X-1), where X represents the number of amino acids of the protein of interest. The length of the single chain peptide must be such that internalization, e.g., phagocytosis, receptor-mediated endocytosis, and the like, of the single chain peptide by a MHC-bearing cell, i.e. a MHC Class I- or MHC Class II-bearing cell, can occur. Furthermore, the OSPF must be of a length to allow presentation by a MHC 10 molecule to a T cell. Preferably, the cell is a MHC Class I-bearing cell. In certain embodiments, Y is at least 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29 or 30 amino acids in length.

As used herein, the term “combination” or “a combination of” refers to two or more single chain peptides.

15 The term “peptide” or “single chain peptide” or “polypeptide” is used in its broadest sense, i.e., any polymer of amino acids (dipeptide or greater) linked through peptide bonds. Thus, the term “peptide” includes proteins, oligopeptides, protein fragments, mutants, fusion proteins and the like. The term “protein” is used herein to designate a naturally occurring polypeptide. Peptides of the present invention can be 20 made synthetically, using techniques that are known in the art, or encoded by a nucleic acid, such as DNA or RNA.

The present invention also includes a recombinant molecule comprising a 25 nucleic acid sequence encoding an OSPF(s), operatively linked to a vector capable of being expressed in a host cell. As used herein, “operatively linked” refers to insertion of a nucleic acid sequence into an expression vector in such a manner that the sequence is capable of being expressed when transformed into a host cell. As used herein, an “expression vector” is an RNA or DNA vector capable of transforming a host cell and effecting expression of an appropriate nucleic acid sequence, preferably replicating within the host cell. An expression vector can be either prokaryotic or 30 eukaryotic, and typically is a virus or a plasmid. Suitable host cells can be any cells that are capable of producing the peptides of the present invention. Such host cells include, but are not limited to, bacterial, fungal, insect and mammalian cells. Host cells of the present invention can also be cells which naturally express an MHC

molecule, or are capable of expressing an MHC molecule, and can produce the peptides of the present invention and present them on a MHC molecule. Suitable host cells also include mammalian cells which express MHC molecules on their cell surface and are capable of stimulating an immune response. Examples include, but 5 are not limited to, T cells and antigen presenting cells, such as B cells, dendritic cells, and macrophages. Other examples include non-immune cells which express MHC class I molecules on the cell surface, and include, but are not limited to, fibroblasts, epithelial cells and endothelial cells.

The term “overlapping synthetic peptide formulation (OSPF)-associated 10 disorder” includes any disease, disorder or condition which can be treated or prevented through the modulation, *e.g.*, up-regulation or down-regulation, of an immune response. In certain embodiments, the immune response is a Th-1-mediated immune response, such as a CTL-mediated immune response. In another embodiment, the immune response is a Th2-mediated immune response, such as an 15 antibody-associated immune response. In certain embodiments, OSPF-associated disorders include disorders in which CTL activity is low, aberrant or absent. In other embodiments, the OSPF-associated disorder is an intracellular infection, *e.g.*, a viral infection, a bacterial infection, a parasitic infection, toxic poisoning, prion disease and a neoplastic disease.

The term “protein of interest” refers to any protein associated with an OSPF- 20 associated disorder. Examples of proteins of interest include, but are not limited to, HIV Gag protein (SEQ ID NO:239) SIV Envelope protein (SEQ ID NO:240); anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein 25 (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive 30 protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); *S. aureus* enterotoxin A (SEQ ID NO:226); *E. coli* enterotoxin A

(SEQ ID NO:227); C. difficile enterotoxin A (SEQ ID NO:228); B. cereus enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ ID NO:230); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein 5 (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235). For example, OSPFs for HIV-1 Gag include the peptides set forth as SEQ ID NO:1-122 and/or SEQ ID NO:236-335 and OSPFs for SIV Envelope protein include the peptides set forth as SEQ ID NO:123-206 and/or 336-338.

10 The methods of the present invention are effective for preventing, treating or eliminating disease caused by a variety of viruses such as, but not limited to, HIV, e.g., HIV-1 and HIV-2, human herpes viruses, cytomegalovirus (esp. Human), Rotavirus, Epstein-Barr virus, Varicella Zoster Virus, hepatitis viruses, such as hepatitis B virus, hepatitis A virus, hepatitis C virus and hepatitis E virus, 15 coronaviruses (e.g. SARS coronavirus), orthopoxviruses (e.g. monkeypox and smallpox), paramyxoviruses: Respiratory Syncytial virus, parainfluenza virus, measles virus, mumps virus, human papilloma viruses (for example HPV6, 11, 16, 18 and the like), flaviviruses (e.g. Yellow Fever Virus, Dengue Virus, Tick-borne encephalitis virus, Japanese Encephalitis Virus) or influenza virus.

20 The methods of the present invention are effective for preventing, treating or eliminating disease caused by a variety of bacterial organisms, including gram-positive and gram-negative bacteria. Examples include, but are not limited to, Neisseria spp, including N. gonorrhoea and N. meningitidis, Streptococcus spp, including S. pneumoniae, S. pyogenes, S. agalactiae, S. mutans; Haemophilus spp, 25 including H. influenzae type B, non typeable H. influenzae, H. ducreyi; Moraxella spp, including M catarrhalis, also known as Branhamella catarrhalis; Bordetella spp, including B. pertussis, B. parapertussis and B. bronchiseptica; Mycobacterium spp., including M. tuberculosis, M. bovis, M. leprae, M. avium, M. paratuberculosis, M. smegmatis; Legionella spp, including L. pneumophila; Escherichia spp, including enterotoxic E. coli, enterohemorrhagic E. coli, enteropathogenic E. coli; Vibrio spp, including V. cholera, Shigella spp, including S. sonnei, S. dysenteriae, S. flexnerii; Yersinia spp, including Y. enterocolitica, Y. pestis, Y. pseudotuberculosis, Campylobacter spp, including C. jejuni and C. coli; Salmonella spp, including S.

typhi, S. paratyphi, S. choleraesuis, S. enteritidis; Listeria spp., including L. monocytogenes; Helicobacter spp, including H. pylori; Pseudomonas spp, including P. aeruginosa, Staphylococcus spp., including S. aureus, S. epidermidis; Enterococcus spp., including E. faecalis, E. faecium; Clostridium spp., including C. tetani, C. botulinum, C. difficile; Bacillus spp., including B. anthracis; Corynebacterium spp., including C. diphtheriae; Borrelia spp., including B. burgdorferi, B. garinii, B. afzelii, B. andersonii, B. hermsii; Ehrlichia spp., including E. equi and the agent of the Human Granulocytic Ehrlichiosis; Rickettsia spp, including R. rickettsii; Chlamydia spp., including C. trachomatis, C. neumoniae, C. psittaci; Leptira spp., including L. interrogans; Treponema spp., including T. pallidum, T. denticola, T. hyodysenteriae. Preferred bacteria include, but are not limited to, Listeria, mycobacteria, mycobacteria (e.g., tuberculosis), Anthrax, Salmonella and Listeria monocytogenes.

The methods of the present invention are effective for preventing, treating or eliminating disease caused by a variety of protozoal and parasitic organisms such as, but not limited to, Anaplasma, Babesia, Balantidium, Besnoitia, Chlamydia, Coccidia, Cryptosporondium, Cytauxzoon, Eimeria Entamoeba, Eperythrozoon, Erlichia, Giardia, Haemobartonella, Hammondia, Isopora, Leishmania, Neorickettsia, Plasmodium, Pneumocystis, Rickettsia, Schistosoma, Sarcocystis, Theileria, Thrichinella, Toxoplasma, Trichomonas, Trypanosoma, Unicaria, Dipylidium, Echinococcuse, Taenia, Ancylostoma, Ascaris, Enterobius, Strongyloides, Strongylus, Toxocara, Toxascaris and Trichuris. The methods are particularly useful for treating blood-borne protozoal and parasitic diseases.

As used herein, the term "state of toxicity" or "toxin-induced condition" refers to the quality of being poisonous, *i.e.* that caused by a poison or toxin. As used in the art, this term also refers to the degree of virulence of a toxic microbe or of a poison. By "toxin" it is meant a poisonous substance of biological origin, which necessarily excludes synthetic toxins which are not encoded by a living organism. The toxins are usually, but are not necessarily, proteins. The methods of the present invention for treating and preventing a toxin-related OSPF disorder are effective for preventing, treating or eliminating toxicity caused by a variety of toxins. Nonlimiting examples of protein toxins include botulin, perfringens toxin, pertussis, mycotoxins, shigatoxins, staphylococcal enterotoxin B, tetanus, ricin, cholera, aflatoxins, diphtheria, T2, seguitoxin, saxitoxin, abrin, cyanoginosin, alphatoxin, tetrodotoxin,

aconotoxin, snake venom, scorpion venom and other spider venoms. A nonlimiting example of a non-protein toxin is trichothecene (T-2). Toxin-producing microorganisms of interest include, but are not limited to: *Corynebacterium diphtheriae*, *Staphylococci*, *Salmonella typhimurium*, *Shigellae*, *Pseudomonas aeruginosa*, *Vibrio cholerae*, *Clostridium botulinum*, and *Clostridium tetani*. A nonlimiting example of a toxin producing plant is *Ricinus communis*, and of a fungus producing a toxin is *Aspergillus favus*.

The methods of the present invention are effective for preventing, treating or eliminating disease caused by prions, such as, but not limited to, familial Creutzfeldt-Jakob disease, Gerstmann-Straussler-Scheinker disease, bovine spongiform encephalopathy (BSE), scrapie and fatal familial Insomnia. As used herein, the term "prion" or "prion disease" refers to a group of transmissible spongiform encephalopathies or TSE. TSEs are caused by abnormalities of the prion protein (PrP). For example, Creutzfeldt-Jakob disease is caused by the conversion of the normal protease-sensitive PrP isoform, designated PrP(C), to a protease resistant isoform, designated PrP(Sc). The change of PrPC into PrPSc can occur spontaneously, however, it can also be induced by PrPSc. PrP(Sc) forms into an infectious particle, named a 'prion' that can transmit the disease. The process by which prions proceed to the central nervous system (CNS) following peripheral uptake is referred to as neuroinvasion. Accumulation of PrP(Sc) in the brain causes degenerative disorders affecting the CNS leading to neurodegeneration.

As used herein, the term "neoplastic disease" is characterized by malignant tumor growth or in disease states characterized by benign hyperproliferative and hyperplastic cells. The common medical meaning of the term "neoplasia" refers to "new cell growth" that results as a loss of responsiveness to normal growth controls, e.g., neoplastic cell growth.

As used herein, the terms "hyperproliferative", "hyperplastic", "malignant" and "neoplastic" are used interchangeably, and refer to those cells in an abnormal state or condition characterized by rapid proliferation or neoplasia. The terms are meant to include all types of hyperproliferative growth, hyperplastic growth, cancerous growths or oncogenic processes, metastatic tissues or malignantly transformed cells, tissues, or organs, irrespective of histopathologic type or stage of invasiveness. A "hyperplasia" refers to cells undergoing an abnormally high rate of growth. However,

as used herein, the terms neoplasia and hyperplasia can be used interchangeably, as their context will reveal, referring generally to cells experiencing abnormal cell growth rates. Neoplasias and hyperplasias include "tumors," which may be either benign, premalignant or malignant.

5        The terms "neoplasia," "hyperplasia," and "tumor" are often commonly referred to as "cancer," which is a general name for more than 100 diseases that are characterized by uncontrolled, abnormal growth of cells. Examples of cancer include, but are not limited to: breast; colon; non-small cell lung, head and neck; colorectal; lung; prostate; ovary; renal; melanoma; and gastrointestinal (*e.g.*, pancreatic and stomach) cancer; and osteogenic sarcoma.

10      The term "tumor antigen" as used herein relates to any antigen expressed on a tumor cell, including but not limited to, Mucin1, carcinoembryonic antigen, oncofetal antigens and tumor-associated antigens. Also included in this definition are any antigens expressed by tumor cells that are encoded by a single DNA strand.

15      The terms "induce", "inhibit", "potentiate", "elevate", "increase" "decrease" or the like, denote quantitative differences between two states, refer to at least statistically significant differences between the two states. For example, "an amount effective to inhibit growth of hyperproliferative cells" means that the rate of growth of the cells will at least statistically significantly different from the untreated cells. Such 20     terms are applied herein to, for example rates of cell proliferation.

25      As used herein, the term "subject" is intended to include all vertebrates, *i.e.* human and non-human animals. The term "non-human animals" of the invention includes, but is not limited to, mammals, rodents, mice, and non-mammals, such as non-human primates, sheep, dog, horse, cow, chickens, amphibians, reptiles and the like. In one embodiment, the subject is a mammal, *e.g.*, a primate, *e.g.*, a human. In another embodiment, human animals include a human patient suffering from or prone 30     to suffering from an OSPF-associated disorder.

      The term "treatment" or "treating" as used herein refers to either (1) the prevention of a disease or disorder (prophylaxis), or (2) the reduction or elimination of symptoms of the disease or disorder (therapy).

      The terms "prevention", "prevent" or "preventing" as used herein refers to inhibiting, averting or obviating the onset or progression of a disease or disorder (prophylaxis).

As used herein, the terms “immune” and “immunity” refers to the quality or condition of being able to resist a particular disease.

The terms “immunize” and “immunization,” as used herein, refer to the act of making a subject (1) not susceptible to a disease or disorder; or (2) less responsive to 5 a disease or disorder; or (3) have an increased degree of resistance to a disease or disorder.

The term “MHC-bearing cell” refers to any cell which expresses an MHC molecule, *i.e.* MHC Class I or Class II molecule, on the cell surface. In humans, almost all nucleated cells express MHC Class I molecules, although the level of 10 expression varies between cell types. Cells of the immune system express abundant MHC Class I on their surfaces, while liver cells express relatively low levels. MHC Class II molecules are primarily expressed on immune cells, particularly antigen presenting cells, *i.e.*, B cells, dendritic cells, monocytes and macrophages. However, many other cell types can be induced to express MHC Class II molecules and are also 15 meant to be within the scope of the invention. MHC molecules often have different names between vertebrates. For example, MHC is often referred to as HLA in humans and H-2 in mice. These differences in nomenclature are intended to be within the scope of the present invention.

The term “immune cell” includes cells of the immune system which are capable 20 of expressing, producing or secreting cytokines that regulate an immune response, for example a type-1 (Th1) or type-2 (Th2) immune response. Preferred immune cells include human immune cells. Exemplary preferred immune cells include, but are not limited to, macrophages, dendritic cells, T cells, B cells and neutrophils.

As used herein, the term “T cell” (*i.e.* T lymphocytes) is intended to include 25 all cells within the T cell lineage, including thymocytes, immature T cells, mature T cells (including T cells bearing the surface markers CD4 and/or CD8) and the like, from a mammal (*e.g.* human or mouse). Preferably, the T cell is a CD8<sup>+</sup> T cell, also referred to herein as a “cytotoxic T lymphocyte” or “CTL”, or a CD4<sup>+</sup> T cell, also referred to herein as a “helper T lymphocyte” or “Th lymphocyte”. MHC Class II 30 molecules present antigen to CD4<sup>+</sup> Th cells and once activated, Th cells contribute to the activation of CTLs and B lymphocytes via physical contact and cytokine release.

As used herein, “cytotoxicity” or “induce the killing” of an infected cell or hyperproliferative cell, *e.g.* neoplastic cell, *e.g.* benign hyperplastic cell, refers to the

partial or complete elimination of such cells by a CD8+ T cell (or CTL), and does not necessarily indicate a total elimination of the infection or neoplastic growth.

The term "cytokine" is meant to include any one of the group of hormone-like mediators produced by T and B lymphocytes. Representative cytokines include but 5 are not limited to Interleukin-1 (IL-1), IL2, IL3, IL4, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-11, IL-12, IL-13, IL-15, IL-18, Interferon gamma (IFN- $\gamma$ ), Tumor Necrosis Factor alpha (TNF- $\alpha$ ), and Transforming Growth Factor-beta (TGF- $\beta$ ). An "active" fragment of a cytokine is a fragment of a cytokine that retains activity as determined using standard *in vitro* and *in vivo* assays. For example, assays for determining IL2 10 and IFN- $\gamma$  activity are known in the art (See e.g. Campos, M. (1989) *Cell. Immun.* 120:259-269 and Czarniecki, C. W. (1986) *J. Interferon Res.* 6:29-37.) Assays for determining the activity of other cytokines are known and can readily be conducted by those having ordinary skill in the art.

The term "immune response" includes any response associated with immunity 15 including, but not limited to, increases or decreases in cytokine expression, production or secretion (e.g., IL-12, IL-10, TGF $\beta$  or TNF $\alpha$  expression, production or secretion), cytotoxicity, immune cell migration, antibody production and/or immune cellular responses. The phrase "modulating an immune response" or "modulation of an immune response" includes upregulation, potentiating, stimulating, enhancing or 20 increasing an immune response, as defined herein. For example, an immune response can be upregulated, enhanced, stimulated or increased directly by use of a modulator of the present invention (e.g., a stimulatory modulator). Alternatively, a modulator can be used to "potentiate" an immune response, for example, by enhancing, stimulating or increasing immune responsiveness to a stimulatory modulator. The 25 phrase "modulating an immune response" or "modulation of an immune response" also includes downregulation, inhibition or decreasing an immune response as defined herein.

Immune responses in a subject or patient can be further characterized as being either type-1 or type-2 immune responses.

A "type-1 immune response", also referred to herein as a "type-1 response" or 30 a "T helper type 1 (Th1) response" includes a response by CD4 $^{+}$  T cells that is characterized by the expression, production or secretion of one or more type-1 cytokines and that is associated with delayed type hypersensitivity responses. The

phrase “type-1 cytokine” includes a cytokine that is preferentially or exclusively expressed, produced or secreted by a Th1 cell, that favors development of Th1 cells and/or that potentiates, enhances or otherwise mediates delayed type hypersensitivity reactions. Preferred type-1 cytokines include, but are not limited to, GM-CSF, IL-2,  
5 IFN- $\gamma$ , TNF- $\alpha$ , IL-12, IL-15 and IL-18.

Included within a Th1-mediated response is a CTL-mediated immune response. The term “CTL-mediated immune response” includes any response associated with cytotoxic T cell (CD8 $^{+}$  T cell) immunity including, but not limited to, increases or decreases in cytokine expression, production or secretion (e.g., IL-2, IL-  
10 12, IL-15, or IFN- $\gamma$  expression, production or secretion), cytotoxicity, immune cell migration, antibody production and/or immune cellular responses. The phrase “modulating a CTL-mediated immune response” or “modulation of a CTL-mediated immune response” includes upregulation, potentiating, stimulating, enhancing or increasing an immune response, as defined herein. For example, a CTL-mediated  
15 immune response can be upregulated, enhanced, stimulated or increased directly by use of an OSPF of the present invention (e.g., a stimulatory modulator). Alternatively, an OSPF can be used to “potentiate” a CTL-mediated immune response, for example, by enhancing, stimulating or increasing immune responsiveness to a stimulatory modulator. The phrase “modulating a CTL-mediated  
20 immune response” or “modulation of a CTL-mediated immune response” also includes downregulation, inhibition or decreasing a CTL-mediated immune response as defined herein.

The phrase “type-1 immunity” includes immunity characterized predominantly by type-1 immune responses (e.g., cellular cytotoxicity, delayed type  
25 hypersensitivity, and/or macrophage activation), by expression, production or secretion of at least one type-1 cytokine and/or expression of a type-1 immunity cytokine profile. The phrase “potentiating or potentiation of a type-1 or type-2 immune response” includes upregulation, stimulation or enhancement of a type-1 or type-2 response, respectively (e.g., commitment of T helper precursors to either a Th1  
30 or Th2 lineage, further differentiation of cells to either the Th1 or Th2 phenotype and/or continued function of Th1 or Th2 cells during an ongoing immune response). For a review of Th1 and Th2 subsets see, for example, Seder and Paul (1994) *Ann. Rev. Immunol.* 12:635-673.

A "type-2 immune response", also referred to herein as a "type-2 response or a "T helper type 2 (Th2) response" refers to a response by CD4<sup>+</sup> T cells that is characterized by the production of one or more type-2 cytokines and that is associated with humoral or antibody-associated immunity (*e.g.*, efficient B cell, "help" provided by Th2 cells, for example, leading to enhanced modification of certain IgG subtypes and/or IgE). The phrase "type-2 cytokine" includes a cytokine that is preferentially or exclusively expressed, produced or secreted by a Th2 cell, that favors development of Th2 cells and/or that potentiates, enhances or otherwise mediates antibody production by B lymphocytes. Preferred type-2 cytokines include, but are not limited to, IL-4, IL-5, IL-6, IL-10, and IL-13.

As used herein, the term "activity", "biological activity" or "functional activity", refers to an activity exerted by a molecule of the invention *e.g.*, an OSPF, as determined *in vivo*, or *in vitro*, according to standard techniques and/or methods such as those described in the Examples.

15

### *Embodiments of the Invention*

The present invention provides, at least in part, methods and compositions for the treatment of immune disorders, such as, for example, viral, bacterial and parasitic infections, prion disease, neoplastic diseases and protection against toxins. The invention is based on the discovery that overlapping synthetic peptide formulations (OSPFs) of the present invention are able to modulate a cytotoxic T lymphocyte (CTL)-mediated response.

Accordingly, the present invention provides a method of modulating, *e.g.* inducing, an immune response, *i.e.*, a Th1-mediated immune response such as a CTL-mediated immune response or a Th2-mediated immune response and an antibody-associated immune response, by administering to a subject, *e.g.*, a vertebrate, such as a human, an effective amount of an OSPF. The OSPF of the present invention includes a combination, *i.e.*, two or more, of single chain peptides that correspond to an amino acid sequence of a protein of interest, such that the single chain peptide is a length represented by Y, wherein Y is at least 7 to (X-1) and where X is the number of amino acids of the protein of interest, and where at least 1 single chain peptide overlaps with another single chain peptide by a length of Z, wherein Z is 1 to (Y-1),

such that the length of the single chain peptide is such that it is able to be internalized by a MHC-bearing cell and can be presented on a MHC molecule to a T cell.

In another embodiment, the OSPF of the present invention includes a combination of single chain peptides that correspond to an amino acid sequence of a protein of interest, such that the single chain peptide is a length represented by Y, wherein Y is at least 7 to (X-1) and where X is the number of amino acids of the protein of interest, such that the length of the single chain peptide is such that it is able to be internalized by a MHC-bearing cell and can be presented on a MHC molecule to a T cell.

10 In a particular embodiment, Y is at least 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, or 30 amino acids.

In another embodiment, the overlap between single chain peptides is at least 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28 or 29 amino acids.

15 The invention also includes several variations of an OSPF. Examples include, but are not limited to, an OSPF alone or in combination with other proteins or peptides, *e.g.*, a single set of OSPFs from one protein of interest; two or more OSPFs from the same organism or tumor, but different proteins of interest; different OSPFs from different proteins of interest from different organisms or tumors; a single set of 20 OSPFs from a protein of interest and a killed or attenuated organism; a single set of OSPFs and a tumor-related protein (*i.e.* a tumor antigen); a single set of OSPFs from a protein of interest one or more antibody epitopic peptides; and a single set of OSPFs and one or more Th-related epitopic peptides.

25 The number of single chain peptides, the length of single chain peptides, and the amount of overlap between single chain peptides will depend on several characteristics of the protein of interest, including the length. These factors can be determined by one skilled in the art without undue experimentation through the use of commercially available computer programs, such as Potean II™ (Proteus) and SPOT™. This allows for several possible epitopes to be encompassed within the 30 OSPF of the present invention, therefore eliminating the cumbersome and expensive step of epitope identification.

In yet another embodiment, the protein of interest includes, but is not limited to, HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ ID NO:340);

anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); S. aureus enterotoxin A (SEQ ID NO:226); E. coli enterotoxin A (SEQ ID NO:227); C. difficile enterotoxin A (SEQ ID NO:228); B. cereus enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ ID NO:230)); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235). For example, OSPFs for HIV-1 Gag include the peptides set forth as SEQ ID NO:1-122 and/or SEQ ID NO:236-335 and OSPFs for SIV Envelope protein include the peptides set forth as SEQ ID NO:123-206 and/or 336-338. For example, OSPFs for HIV-1 Gag include the peptides set forth as SEQ ID NO:1-122 and/or SEQ ID NO:236-335 and OSPFs for SIV Envelope protein include the peptides set forth as SEQ ID NO:123-206 and/or 336-338.

25 ***Therapeutic Methods***

The present invention provides for therapeutic methods of treating subjects (*e.g.*, vertebrates, such as humans). In one aspect, the invention pertains to a method of treating an OSPF-associated disorder, *e.g.*, any disease, disorder, or condition which can be treated or prevented by modulating an immune response, *i.e.*, a Th1-mediated immune response such as a CTL-mediated immune response or a Th2-mediated immune response, such as an antibody-associated response, in a subject. In one embodiment, the present invention includes administering to a subject having an

OSPF-associated disorder, an effective amount of an OSPF of the present invention, thereby treating the OSPF-associated disorder in the subject.

Also within the scope of this invention is the administration of an OSPF prophylactically. Administration of an OSPF of the present invention can occur prior to the manifestation of symptoms of an OSPF-associated disorder, such that the disorder is prevented or, alternatively, delayed in its progression. The prophylactic methods of the present invention can be carried out in a similar manner to the therapeutic methods described herein, although dosage and treatment regimens may differ.

Accordingly, the present method has therapeutic utility in modulating an immune response. In one embodiment, the present method has therapeutic utility in biasing an immune response towards a Th1-mediated (*i.e.*, CTL-mediated) immune response depending upon the desired therapeutic regimen. In another embodiment, the present invention has therapeutic utility in biasing an immune response towards a Th2-mediated (*i.e.*, antibody-associated immunity). Such methods are particularly useful in diseases such as viral infections (*e.g.*, Ebola virus, hepatitis C, HIV, *e.g.*, HIV-1 and HIV-2, RSV, monkeypox, and SARS coronavirus), bacterial infections (*e.g.*, anthrax, Listeria monocytogenes, Legionella and mycobacterium such as tuberculosis), parasitic infections (*e.g.* malaria) protection against toxins (*e.g.*, shigella toxin, toxin botulinum and tetanus toxin), prion diseases, and neoplastic diseases (*e.g.*, breast, colon, non-small cell lung, head and neck, colorectal, lung, prostate, ovary, renal, melanoma, gastrointestinal (*e.g.*, pancreatic and stomach) cancer and osteogenic sarcoma).

In another aspect, the invention provides a vaccine for immunizing a subject against an OSPF-associated disorder, wherein the vaccine comprises an OSPF of the present invention, either alone or dispersed in a physiologically acceptable, nontoxic vehicle in an amount is effective to immunize a subject against an OSPF disorder.

The vaccines of the present invention are administered in a manner compatible with the dosage formulation, and in such amount as will be therapeutically effective and immunogenic. The quantity to be administered depends on the subject to be treated, capacity of the subject's immune system to generate a cellular immune response, and degree of protection desired. Precise amounts of active ingredient required to be administered depend on the judgment of the practitioner and are

peculiar to each individual. However, suitable dosage ranges are of the order of about one microgram to about one milligram, preferably about 25 micrograms and more preferably about 30 micrograms active ingredient per kilogram per 70 kilogram individual. Suitable regimes for initial administration and booster shots are also 5 variable, but are typified by an initial administration followed in one or two week intervals by a subsequent injection or other administration. Also within the scope of the invention is the co-administration of an adjuvant in combination with an OSPF of the present invention. Suitable adjuvants include, but are not limited to, IL-2, IL-12, IL-15, alum, Concanavalin A, phorbol esters and Freud's adjuvant.

10 In yet another aspect, the invention features a kit for immunizing a subject against an OSPF-associated disorder wherein the kit comprises an OSPF of the present invention and may further comprise instructions for use.

15 In yet another aspect, the invention features a vaccine adjuvant which comprises an OSPF of the present invention and a pharmaceutically acceptable carrier which may be used to enhance the efficacy of a vaccine.

#### ***Pharmaceutical Compositions and Uses thereof***

Another aspect of the present invention provides pharmaceutically-acceptable compositions which comprise an OSPF and a pharmaceutically-acceptable carrier(s), 20 in an amount effective to modulate a CTL-mediated immune response.

In a particular embodiment, the OSPF is administered to the subject using a pharmaceutically-acceptable formulation, e.g., a pharmaceutically-acceptable formulation that provides sustained delivery of the OSPF to a subject for at least 12 hours, 24 hours, 36 hours, 48 hours, one week, two weeks, three weeks, or four weeks 25 after the pharmaceutically-acceptable formulation is administered to the subject.

In certain embodiments, these pharmaceutical compositions are suitable for oral administration to a subject. In other embodiments, as described in detail below, the pharmaceutical compositions of the present invention may be specially formulated for administration in solid or liquid form, including those adapted for the following: 30 (1) oral administration, for example, drenches (aqueous or non-aqueous solutions or suspensions), tablets, boluses, powders, granules, pastes; (2) parenteral administration, for example, by subcutaneous, intramuscular or intravenous injection as, for example, a sterile solution or suspension; (3) topical application, for example,

as a cream, ointment or spray applied to the skin; (4) intravaginally or intrarectally, for example, as a pessary, cream or foam; or (5) aerosol, for example, as an aqueous aerosol, liposomal preparation or solid particles containing the compound.

As used herein, the term "effective amount" includes an amount effective, at 5 dosages and for periods of time necessary, to achieve the desired result, e.g., sufficient to modulate a CTL-mediated immune response. An effective amount of OSPF, as defined herein may vary according to factors such as the disease state, age, and weight of the subject, and the ability of the OSPF to elicit a desired response in the subject. Dosage regimens may be adjusted to provide the optimum therapeutic response. An 10 effective amount is also one in which any toxic or detrimental effects (e.g., side effects) of the OSPF of the present invention are outweighed by the therapeutically beneficial effects.

A therapeutically effective amount of OSPF (*i.e.*, an effective dosage) may range from about 0.001 to 40 µg/kg body weight, preferably about 0.01 to 30 µg/kg 15 body weight per 70 kilogram individual. The skilled artisan will appreciate that certain factors may influence the dosage required to effectively treat a subject, including but not limited to the severity of the disease or disorder, previous treatments, the general health and/or age of the subject, and other diseases present. Moreover, treatment of a subject with a therapeutically effective amount of an OSPF 20 can include a single treatment or, can include a series of treatments. In one example, a subject is treated with an OSPF in the range of between about 0.1 to 30 µg/kg body weight, one time per week for between about 1 to 10 weeks, preferably between 2 to 8 weeks, more preferably between about 3 to 7 weeks, and even more preferably for about 4, 5, or 6 weeks. It will also be appreciated that the effective dosage of an 25 OSPF used for treatment may increase or decrease over the course of a particular treatment.

The methods of the invention further include administering to a subject a therapeutically effective amount of an OSPF in combination with another pharmaceutically active compound known to modulate, for example, a CTL-mediated 30 immune responses, *e.g.*, agents such as interleukins (IL) (*e.g.* IL-2, IL-12, IL-15), lipopolysaccharide (LPS), concanavalin A (ConA), phorbol esters, and ionomycin. Other pharmaceutically active compounds that may be used to modulate a TH2-mediated immune response, for example, can be found in *Harrison's Principles of*

*Internal Medicine*, Thirteenth Edition, Eds. T.R. Harrison *et al.* McGraw-Hill N.Y., NY; and the Physicians Desk Reference 50th Edition 1997, Oradell New Jersey, Medical Economics Co., the complete contents of which are expressly incorporated herein by reference. The OSPF and the pharmaceutically active compound may be 5 administered to the subject in the same pharmaceutical composition or in different pharmaceutical compositions (at the same time or at different times).

The regimen of administration also can affect what constitutes an effective amount. OSPFs of the present invention can be administered to the subject prior to, simultaneously with, or after the administration of the other agent(s). Further, several 10 divided dosages, as well as staggered dosages, can be administered daily or sequentially, or the dose can be proportionally increased or decreased as indicated by the exigencies of the therapeutic situation.

The phrase "pharmaceutically acceptable" is employed herein to refer to those OSPFs of the present invention, compositions containing such compounds, and/or 15 dosage forms which are, within the scope of sound medical judgment, suitable for use in contact with the tissues of human beings and animals without excessive toxicity, irritation, allergic response, or other problem or complication, commensurate with a reasonable benefit/risk ratio.

The phrase "pharmaceutically-acceptable carrier" as used herein means a 20 pharmaceutically-acceptable material, composition or vehicle, such as a liquid or solid filler, diluent, excipient, solvent or encapsulating material, involved in carrying or transporting the subject chemical from one organ, or portion of the body, to another organ, or portion of the body. Each carrier must be "acceptable" in the sense of being compatible with the other ingredients of the formulation and not injurious to the 25 subject. Some examples of materials which can serve as pharmaceutically-acceptable carriers include: (1) sugars, such as lactose, glucose and sucrose; (2) starches, such as corn starch and potato starch; (3) cellulose, and its derivatives, such as sodium carboxymethyl cellulose, ethyl cellulose and cellulose acetate; (4) powdered tragacanth; (5) malt; (6) gelatin; (7) talc; (8) excipients, such as cocoa butter and 30 suppository waxes; (9) oils, such as peanut oil, cottonseed oil, safflower oil, sesame oil, olive oil, corn oil and soybean oil; (10) glycols, such as propylene glycol; (11) polyols, such as glycerin, sorbitol, mannitol and polyethylene glycol; (12) esters, such as ethyl oleate and ethyl laurate; (13) agar; (14) buffering agents, such as magnesium

hydroxide and aluminum hydroxide; (15) alginic acid; (16) pyrogen-free water; (17) isotonic saline; (18) Ringer's solution; (19) ethyl alcohol; (20) phosphate buffer solutions; and (21) other non-toxic compatible substances employed in pharmaceutical formulations.

5 Wetting agents, emulsifiers and lubricants, such as sodium lauryl sulfate and magnesium stearate, as well as coloring agents, release agents, coating agents, sweetening, flavoring and perfuming agents, preservatives and antioxidants can also be present in the compositions.

10 Examples of pharmaceutically-acceptable antioxidants include: (1) water soluble antioxidants, such as ascorbic acid, cysteine hydrochloride, sodium bisulfate, sodium metabisulfite, sodium sulfite and the like; (2) oil-soluble antioxidants, such as ascorbyl palmitate, butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), lecithin, propyl gallate, alpha-tocopherol, and the like; and (3) metal chelating agents, such as citric acid, ethylenediamine tetraacetic acid (EDTA), sorbitol, tartaric acid, phosphoric acid, and the like.

15

Compositions containing an OSPF(s) include those suitable for oral, nasal, topical (including buccal and sublingual), rectal, vaginal, aerosol and/or parenteral administration. The compositions may conveniently be presented in unit dosage form and may be prepared by any methods well known in the art of pharmacy. The amount  
20 of active ingredient which can be combined with a carrier material to produce a single dosage form will vary depending upon the host being treated, the particular mode of administration. The amount of active ingredient which can be combined with a carrier material to produce a single dosage form will generally be that amount of the compound which produces a therapeutic effect. Generally, out of one hundred per  
25 cent, this amount will range from about 1 per cent to about ninety-nine percent of active ingredient, preferably from about 5 per cent to about 70 per cent, most preferably from about 10 per cent to about 30 per cent.

Methods of preparing these compositions include the step of bringing into association an OSPF(s) with the carrier and, optionally, one or more accessory  
30 ingredients. In general, the formulations are prepared by uniformly and intimately bringing into association an OSPF with liquid carriers, or finely divided solid carriers, or both, and then, if necessary, shaping the product.

Compositions of the invention suitable for oral administration may be in the form of capsules, cachets, pills, tablets, lozenges (using a flavored basis, usually sucrose and acacia or tragacanth), powders, granules, or as a solution or a suspension in an aqueous or non-aqueous liquid, or as an oil-in-water or water-in-oil liquid emulsion, or as an elixir or syrup, or as pastilles (using an inert base, such as gelatin and glycerin, or sucrose and acacia) and/or as mouth washes and the like, each containing a predetermined amount of an OSPF(s) as an active ingredient. An OSPF may also be administered as a bolus, electuary or paste.

In solid dosage forms of the invention for oral administration (capsules, tablets, pills, dragees, powders, granules and the like), the active ingredient is mixed with one or more pharmaceutically-acceptable carriers, such as sodium citrate or dicalcium phosphate, and/or any of the following: (1) fillers or extenders, such as starches, lactose, sucrose, glucose, mannitol, and/or silicic acid; (2) binders, such as, for example, carboxymethylcellulose, alginates, gelatin, polyvinyl pyrrolidone, sucrose and/or acacia; (3) humectants, such as glycerol; (4) disintegrating agents, such as agar-agar, calcium carbonate, potato or tapioca starch, alginic acid, certain silicates, and sodium carbonate; (5) solution retarding agents, such as paraffin; (6) absorption accelerators, such as quaternary ammonium compounds; (7) wetting agents, such as, for example, acetyl alcohol and glycerol monostearate; (8) absorbents, such as kaolin and bentonite clay; (9) lubricants, such as talc, calcium stearate, magnesium stearate, solid polyethylene glycols, sodium lauryl sulfate, and mixtures thereof; and (10) coloring agents. In the case of capsules, tablets and pills, the pharmaceutical compositions may also comprise buffering agents. Solid compositions of a similar type may also be employed as fillers in soft and hard-filled gelatin capsules using such excipients as lactose or milk sugars, as well as high molecular weight polyethylene glycols and the like.

A tablet may be made by compression or molding, optionally with one or more accessory ingredients. Compressed tablets may be prepared using binder (for example, gelatin or hydroxypropylmethyl cellulose), lubricant, inert diluent, preservative, disintegrant (for example, sodium starch glycolate or cross-linked sodium carboxymethyl cellulose), surface-active or dispersing agent. Molded tablets may be made by molding in a suitable machine a mixture of the powdered active ingredient moistened with an inert liquid diluent.

The tablets, and other solid dosage forms of the pharmaceutical compositions of the present invention, such as dragees, capsules, pills and granules, may optionally be scored or prepared with coatings and shells, such as enteric coatings and other coatings well known in the pharmaceutical-formulating art. They may also be  
5 formulated so as to provide slow or controlled release of the active ingredient therein using, for example, hydroxypropylmethyl cellulose in varying proportions to provide the desired release profile, other polymer matrices, liposomes and/or microspheres.  
They may be sterilized by, for example, filtration through a bacteria-retaining filter, or  
10 by incorporating sterilizing agents in the form of sterile solid compositions which can be dissolved in sterile water, or some other sterile injectable medium immediately before use. These compositions may also optionally contain opacifying agents and may be of a composition that they release the active ingredient(s) only, or preferentially, in a certain portion of the gastrointestinal tract, optionally, in a delayed manner. Examples of embedding compositions which can be used include polymeric  
15 substances and waxes. The active ingredient can also be in micro-encapsulated form, if appropriate, with one or more of the above-described excipients.

Liquid dosage forms for oral administration of the OSPF(s) include pharmaceutically-acceptable emulsions, microemulsions, solutions, suspensions, syrups and elixirs. In addition to the active ingredient, the liquid dosage forms may  
20 contain inert diluents commonly used in the art, such as, for example, water or other solvents, solubilizing agents and emulsifiers, such as ethyl alcohol, isopropyl alcohol, ethyl carbonate, ethyl acetate, benzyl alcohol, benzyl benzoate, propylene glycol, 1,3-butylene glycol, oils (in particular, cottonseed, groundnut, corn, germ, olive, castor and sesame oils), glycerol, tetrahydrofuryl alcohol, polyethylene glycols and fatty  
25 acid esters of sorbitan, and mixtures thereof.

Besides inert diluents, the oral compositions can also include adjuvants such as wetting agents, emulsifying and suspending agents, sweetening, flavoring, coloring, perfuming and preservative agents.

Suspensions, in addition to the active OSPF(s) may contain suspending agents  
30 as, for example, ethoxylated isostearyl alcohols, polyoxyethylene sorbitol and sorbitan esters, microcrystalline cellulose, aluminum metahydroxide, bentonite, agar-agar and tragacanth, and mixtures thereof.

Pharmaceutical compositions of the invention for rectal or vaginal administration may be presented as a suppository, which may be prepared by mixing one or more OSPF(s) with one or more suitable nonirritating excipients or carriers comprising, for example, cocoa butter, polyethylene glycol, a suppository wax or a salicylate, and which is solid at room temperature, but liquid at body temperature and, therefore, will melt in the rectum or vaginal cavity and release the active agent.

5 Compositions of the present invention which are suitable for vaginal administration also include pessaries, tampons, creams, gels, pastes, foams or spray formulations containing such carriers as are known in the art to be appropriate.

10 Dosage forms for the topical or transdermal administration of an OSPF(s) include powders, sprays, ointments, pastes, creams, lotions, gels, solutions, patches and inhalants. The active OSPF(s) may be mixed under sterile conditions with a pharmaceutically-acceptable carrier, and with any preservatives, buffers, or propellants which may be required.

15 The ointments, pastes, creams and gels may contain, in addition to OSPF(s) of the present invention, excipients, such as animal and vegetable fats, oils, waxes, paraffins, starch, tragacanth, cellulose derivatives, polyethylene glycols, silicones, bentonites, silicic acid, talc and zinc oxide, or mixtures thereof.

20 Powders and sprays can contain, in addition to an OSPF(s), excipients such as lactose, talc, silicic acid, aluminum hydroxide, calcium silicates and polyamide powder, or mixtures of these substances. Sprays can additionally contain customary propellants, such as chlorofluorohydrocarbons and volatile unsubstituted hydrocarbons, such as butane and propane.

25 The OSPF(s) can be alternatively administered by aerosol. This is accomplished by preparing an aqueous aerosol, liposomal preparation or solid particles containing the compound. A nonaqueous (*e.g.*, fluorocarbon propellant) suspension could be used. Sonic nebulizers are preferred because they minimize exposing the agent to shear, which can result in degradation of the compound.

30 Ordinarily, an aqueous aerosol is made by formulating an aqueous solution or suspension of the agent together with conventional pharmaceutically-acceptable carriers and stabilizers. The carriers and stabilizers vary with the requirements of the particular compound, but typically include nonionic surfactants (Tweens, Pluronics, or polyethylene glycol), innocuous proteins like serum albumin, sorbitan esters, oleic

acid, lecithin, amino acids such as glycine, buffers, salts, sugars or sugar alcohols. Aerosols generally are prepared from isotonic solutions.

Transdermal patches have the added advantage of providing controlled delivery of an OSPF(s) to the body. Such dosage forms can be made by dissolving or 5 dispersing the agent in the proper medium. Absorption enhancers can also be used to increase the flux of the active ingredient across the skin. The rate of such flux can be controlled by either providing a rate controlling membrane or dispersing the active ingredient in a polymer matrix or gel.

Ophthalmic formulations, eye ointments, powders, solutions and the like, are 10 also contemplated as being within the scope of this invention.

Pharmaceutical compositions of this invention suitable for parenteral administration comprise one or more OSPF(s) in combination with one or more pharmaceutically-acceptable sterile isotonic aqueous or nonaqueous solutions, dispersions, suspensions or emulsions, or sterile powders which may be reconstituted 15 into sterile injectable solutions or dispersions just prior to use, which may contain antioxidants, buffers, bacteriostats, solutes which render the formulation isotonic with the blood of the intended recipient or suspending or thickening agents.

Examples of suitable aqueous and nonaqueous carriers which may be employed in the pharmaceutical compositions of the invention include water, ethanol, 20 polyols (such as glycerol, propylene glycol, polyethylene glycol, and the like), and suitable mixtures thereof, vegetable oils, such as olive oil, and injectable organic esters, such as ethyl oleate. Proper fluidity can be maintained, for example, by the use of coating materials, such as lecithin, by the maintenance of the required particle size in the case of dispersions, and by the use of surfactants.

25 These compositions may also contain adjuvants such as preservatives, wetting agents, emulsifying agents and dispersing agents. Prevention of the action of microorganisms may be ensured by the inclusion of various antibacterial and antifungal agents, for example, paraben, chlorobutanol, phenol sorbic acid, and the like. It may also be desirable to include isotonic agents, such as sugars, sodium 30 chloride, and the like into the compositions. In addition, prolonged absorption of the injectable pharmaceutical form may be brought about by the inclusion of agents which delay absorption such as aluminum monostearate and gelatin.

In some cases, in order to prolong the effect of a drug, it is desirable to slow the absorption of the drug from subcutaneous or intramuscular injection. This may be accomplished by the use of a liquid suspension of crystalline or amorphous material having poor water solubility. The rate of absorption of the drug then depends upon its 5 rate of dissolution which, in turn, may depend upon crystal size and crystalline form. Alternatively, delayed absorption of a parenterally-administered drug form is accomplished by dissolving or suspending the drug in an oil vehicle.

Injectable depot forms are made by forming microencapsule matrices of OSPF(s) in biodegradable polymers such as polylactide-polyglycolide. Depending on 10 the ratio of drug to polymer, and the nature of the particular polymer employed, the rate of drug release can be controlled. Examples of other biodegradable polymers include poly(orthoesters) and poly(anhydrides). Depot injectable formulations are also prepared by entrapping the drug in liposomes or microemulsions which are compatible with body tissue.

15 When the OSPF(s) are administered as pharmaceuticals, to humans and animals, they can be given per se or as a pharmaceutical composition containing, for example, 0.1 to 99.5% (more preferably, 0.5 to 90%) of active ingredient in combination with a pharmaceutically-acceptable carrier.

The term "administration" or "administering" is intended to include routes of 20 introducing the OSPF(s) to a subject to perform their intended function. Examples of routes of administration which can be used include injection (subcutaneous, intravenous, parenterally, intraperitoneally, intrathecal), oral, inhalation, rectal and transdermal. The pharmaceutical preparations are, of course, given by forms suitable for each administration route. For example, these preparations are administered in 25 tablets or capsule form, by injection, inhalation, eye lotion, ointment, suppository, etc. administration by injection, infusion or inhalation; topical by lotion or ointment; and rectal by suppositories. Oral administration is preferred. The injection can be bolus or can be continuous infusion. Depending on the route of administration, the OSPF can be coated with or disposed in a selected material to protect it from natural 30 conditions which may detrimentally effecting its ability to perform its intended function. The OSPF can be administered alone, or in conjunction with either another agent as described above or with a pharmaceutically-acceptable carrier, or both. The OSPF can be administered prior to the administration of the other agent,

simultaneously with the agent, or after the administration of the agent. Furthermore, the OSPF can also be administered in a proform which is converted into its active metabolite, or more active metabolite *in vivo*.

The phrases "parenteral administration" and "administered parenterally" as used herein means modes of administration other than enteral and topical administration, usually by injection, and includes, without limitation, intravenous, intramuscular, intraarterial, intrathecal, intracapsular, intraorbital, intracardiac, intradermal, intraperitoneal, transtracheal, subcutaneous, subcuticular, intraarticulare, subcapsular, subarachnoid, intraspinal and intrasternal injection and infusion.

The phrases "systemic administration," "administered systemically", "peripheral administration" and "administered peripherally" as used herein mean the administration of an OSPF(s), drug or other material, such that it enters the subject's system and, thus, is subject to metabolism and other like processes, for example, subcutaneous administration.

Regardless of the route of administration selected, the OSPF(s), which may be used in a suitable hydrated form, and/or the pharmaceutical compositions of the present invention, are formulated into pharmaceutically-acceptable dosage forms by conventional methods known to those of skill in the art.

**20 Examples**

The invention is further illustrated by the following examples which in no way should be construed as being further limiting.

**1. Example 1: HIV and SIV**

**25 Materials and Methods**

**A. Peptides**

OSPFs corresponding to HIV Gag (SEQ ID NOs:1-122) represent a group of peptides of 15 amino acids in length, with 11-amino acid overlaps between sequential peptides, and spanning the entire HIV Gag protein. Most peptides were approximately 30% pure. OSPFs corresponding to SIV Env (SEQ ID NOs:123-206 and/or 336-338), represent a group of peptides of 20 amino acids in length, with 10 amino acid overlaps between sequential peptides, and spanning the entire SIV Env protein. Most peptides are approximately 80% pure.

Peptide P7G (AMQMLKETI (SEQ ID NO:207)) is an H-2K<sup>d</sup>-restricted CTL epitope of HIV p24 antigen (see, e.g., Doe, B and Walker, C. (1996) *AIDS* 10:793). This peptide was made by the Molecular Biology Core Facilities at the Dana-Farber Cancer Institute (DFCI), and was used as a positive control. The peptide was greater than approximately 97% pure.

A non-epitope peptide, HIV clade C envelope V3 peptide (GPGQAFYAT (SEQ ID NO:208) made by the Molecular Biology Core Facilities, at Dana Farber Cancer Institute, Boston, MA, was used as a negative control peptide. The peptide was approximately 97% pure.

#### **B. Mice and Immunization**

BALB/c (H-2<sup>d</sup>) and C57BL/6 (H-2<sup>b</sup>) (Taconic Farms, NY), were immunized subcutaneously (s.c.) with OSPF-HIV Gag. Each mouse was immunized with 5 µg of each peptide, combined with MLP + TDM Adjuvant System (Sigma, St. Louis, MO; product number M6536. Peptides were >80% pure.). The HIV Gag OSPF was a series of peptides, each 15 amino acids in length, with 11-amino acid overlaps between sequential peptide (NIH AIDS Research and Reference Reagent Program Catalog #5107). Control mice were given adjuvant alone (mock immunization). The immunization regimen is shown below in Table 1:

**Table 1:**

	Week 0	Week 3	Week 6	After week 9
25	Mice ↑	↑	↑	↑
30	OSP-HIV Gag, 5 µg/mouse, s.c.	OSP-HIV Gag, 5 µg/mouse, s.c.	OSP-HIV Gag, 5 µg/mouse, s.c.	<ul style="list-style-type: none"> <li>• CTL assay (restimulation)</li> <li>• ELISPOT,</li> <li>• Proliferation,</li> <li>• Antibody</li> </ul>

C. Blood Donors and Isolation and Differentiation of Blood Dendritic Cells

Leukopacks were provided by anonymous, normal blood donors (Dana-Farber Cancer Institute Blood Bank, Boston, MA). These donors were MHC tissue-typed in Brigham and Women's Hospital (Boston, MA) and shown to have different MHC antigens. Dendritic cells (DC) were isolated and differentiated from peripheral blood mononuclear cells (PBMC). PBMC were cultured in plastic cell-culture flasks and incubated for 2 hrs at 5% CO<sub>2</sub> and 37°C. The adherent cells were collected and incubated in complete RPMI supplemented with interleukin-4 (IL-4) and granulocyte-macrophage colony stimulating factor (GM-CSF) (Stem Cell Technology, Vancouver, Canada) (DC medium). An additional 2 ml of DC medium was added to the culture each day. On day 6, detached cells were collected and transferred into a new flask with fresh DC medium. The purity of the DC cell population was assessed using monoclonal antibodies against specific DC markers (see, e.g., Popov, S., unpublished data). These DC were pulsed overnight with OSPF-SIV Env. The OSPF-SIV Env are a series of peptides of 20 amino acids in length, with 10-amino acid overlaps between sequential peptides (NIH AIDS Research and Reference Reagent Program Catalog #4625). Peptides were >80% pure. DC were irradiated and used to generate CTL *in vitro* by 3 stimulation of autologous PBMC at weekly interval. A CTL assay or ELISPOT was performed one week after the last stimulation.

D. Cytotoxic T Lymphocyte (CTL) Assays

Murine CTL Assays:

For the mouse CTL assay, effector cells were splenic mononuclear cells which were isolated from OSPF- or adjuvant-only immunized mice and restimulated (2 x 10<sup>6</sup>/ml) *in vitro* with 1 µM peptide for 7-10 days. Target cells were P815 cells (H-2<sup>d</sup>, for BALB/c mice) and EL-4 cells (H-2<sup>b</sup>, for B57BL/6 mice). Target cells were labeled with <sup>51</sup>Cr (70 µCi/2 x 10<sup>6</sup> cells; Perkin-Elmer, Boston, MA) and pulsed overnight with or without OSPF-HIV Gag (1 µM), or infected overnight with vaccinia virus [2 plaque forming unit (pfu)/target cell] expressing HIVgag (NIH AIDS Research and Reference Reagent Program cat # vP1289), or wild type vaccinia virus (Therion, Cambridge, MA).

In the case of H-2<sup>d</sup> restricted CTL, a known CTL epitope from HIV p24 antigen P7G (AMQMLKETI)<sup>19</sup> (SEQ ID NO:207) (> 97% pure, Molecular Biology Core Facilities, Dana Farber Cancer Institute, Boston, MA) was included to test if OSPF-HIV Gag could generate P7G specific (H-2<sup>d</sup> restricted) CTL in BALB/c mice.

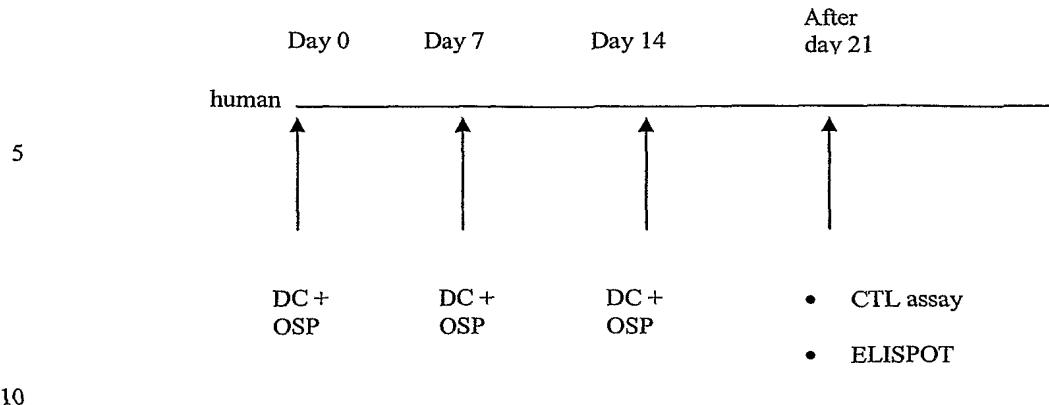
5 A non-epitopic peptide, HIV clade C envelope V3 peptide (GPGQAFYAT) (SEQ ID NO:208), (> 97% pure, Molecular Biology Core Facilities, Dana Farber Cancer Institute, Boston, MA), was used as negative control peptide.

Effector cells and target cells were co-cultured at different ratios for 6 h, and cytotoxicity was determined by <sup>51</sup>Cr release from target cells (see, e.g., Wunderlich *et al.*, (1997) Current Protocols in Immunology 3.11.1-3.11.20). The percentage specific <sup>51</sup>Cr release was calculated as: 100 (experimental release – spontaneous release)/(maximum release – spontaneous release). Maximum release was determined from supernatants of cells that were lysed by addition of 5% Triton-X 100. Spontaneous release was determined from the target cells incubated without addition of effector cells.

#### Human CTL Assays:

For the human CTL assay, effector cells were PBMC stimulated with irradiated autologous DC that had been pulsed with or without OSPF cells (see Table 20 2). Target cells were EBV-transformed, autologous B cell lines. These cells were labeled with <sup>51</sup>Cr (70 µCi/2 x 10<sup>6</sup> cells; Perkin-Elmer, Boston, MA) and pulsed overnight with or without OSPF-SIV Env (1 µM), or infected overnight with vaccinia virus [2 plaque forming unit (pfu)/target cell] expressing SIV gag-pol-env, or wild type vaccinia virus (Vaccinia virus expressing SIV gag-pol-env and wild type 25 vaccinia virus were obtained from Therion, Cambridge, MA).

Effectors cells and target cells were co-cultured and the percentage specific <sup>51</sup>Cr release was calculated as described above in the mouse CTL assay section (see, e.g., Wunderlich, *et al.*, *supra*).

**Table 2:**

10

**E. ELISPOT<sup>TM</sup> Assay**

Human and mouse ELISPOT assays were performed using ELISPOT kits from BioSource International (Camarillo, CA). Briefly, following the final stimulation, mouse splenocytes or human PBMC stimulated with DC (treated with OSPF and untreated) were seeded into anti-interferon gamma (anti-IFN- $\gamma$ ) monoclonal antibody coated 96-well plates and incubated overnight at 4°C. Subsequently, the cells were discarded and biotinylated- anti-IFN- $\gamma$  antibodies were added for an hour at 37°C followed by another hour of incubation at 37°C with anti-biotin antibody labeled with enzyme. After the color reaction developed, spots were counted under a microscope. Results were expressed as spot forming units (SFU)/10<sup>6</sup> cells.

**F. Lymphocyte Proliferation Assay**

Splenic lymphocytes were isolated and cultured at 2 x 10<sup>6</sup> / ml in RPMI 1640 plus 15 % FCS and antibiotics in the presence of HIV Gag protein (15 ug/ml), OSPF-HIV Gag (3 ug/ml) or ovalbumin (OVA) (15 ug/ml) for 5 days. Four hours prior to harvesting, cells were pulsed with 1 uCi per well of <sup>3</sup>H-thymidine. After cells were harvested, <sup>3</sup>H-thymidine incorporation was assessed using a  $\beta$ -counter (Beckman). Results were expressed as count per minute (cpm).

30

ResultsA. OSPF-HIV Gag can promiscuously induce CTL responses in genetically different mice

To determine whether OSPF were able to induce CTL responses in genetically  
5 different mice, BALB/c (H-2<sup>d</sup>) and C57BL/6 (H-2<sup>b</sup>) mice were immunized  
subcutaneously three times at three-week intervals with OSPF-HIV Gag together with  
an oil-in-water adjuvant system MPL+TDM. CTL activity in both mouse strains  
against OSPF-HIV Gag was detected by <sup>51</sup>Cr release assays (Figure 1a). No CTL  
activity was detected in the control mice (adjuvant only). Moreover, these CTLs were  
10 also capable of killing target cells infected with vaccinia virus engineered to express  
HIV Gag (Figure 1b), and, in the case of BALB/c mice, and HIV Gag specific, H-2K<sup>d</sup>  
restricted epitope P7G (Figure 1c). These results suggest that not only are OSPF-HIV  
Gag able to generate specific CTLs, but these cells are capable of killing cells which  
express HIV-Gag protein.

15

B. OSPF-HIV Gag can induce proliferative Th cell responses in genetically  
different mice

To determine whether OSPF are capable of stimulating a proliferative Th cell  
response, BALB/c and C57BL/6 were immunized with OSPF-HIV Gag as described  
20 above. Splenocytes were recovered and cultured *in vitro* with either soluble HIV  
Gag protein, OSPF-HIV Gag or ovalbumin as a control. The proliferative response  
was measured by the percentage of <sup>3</sup>H-thymidine incorporation (Figure 2). These  
results demonstrate that OSPF can induce a proliferative Th response and that  
immunizing with OSPF provides the same proliferative Th-mediated response as does  
25 that of the intact protein.

C. Ex vivo Induction of Dendritic Cells and Autologous PBMCs of Human  
Individuals with Different MHC Class I Backgrounds

OSPF that corresponded to SIV Env (OSPF-SIV Env) were used to induce the  
30 virus-specific CTL responses *ex vivo* using cells from human blood leukopacks  
(dendritic cells (DC) and autologous PBMC). OSPF-SIV Env are a group of 87  
peptides of 20 amino acids in length, with 10 amino acid overlaps between sequential

peptides, and spanning the entire SIV Env protein OSP promiscuously induced CTL in different individuals of different MHC backgrounds.

Cells from two human blood leukopacks from two anonymous donors (d#1 and d#2) were collected and their MHC class I (HLA – A, B, C) were tested [d#1: 5 HLA-A (02, blank); B (08, 18); Bw4 (-,-); Bw6 (+,+); Cw(07, blank). D#2: HLA-A (11, 24); B (39, 51); Bw4 (-,+); Bw6 (+,-); Cw (07, 14)]. The peripheral blood monocytes (PBMC) were separated and stimulated three times in vitro with irradiated autologous dendritic cells (DC) pulsed with or without OSPF-SIV Env at weekly intervals and ELISPOT and chromium release assays were performed one week after 10 the last stimulation.

These results show that PBMC stimulated with DC pulsed with OSPF-SIV Env generated interferon- $\gamma$  secreted cells in both d#1 and d#2 (Figure 3a). The chromium release assay showed that target cells transfected with vaccinia virus expressing SIV gag-pol-env were also killed by CTL (Figure 3b). There was no killing when effector and target cells from two leukopacks were mismatched (data not shown), indicating that the APC from the two leukopacks did not present the same epitopes and the killing was MHC restricted.

20

### Conclusions

These results show that an individual OSPF can generate CTL activity and proliferative Th cell mediated responses in genetically different strains of mice. Furthermore, OSPF can generate CTL activity in human cells with different HLA 25 subtypes. The data also shows that immunization with OSPF(s) can result in the generation of antigen-specific CTL cells capable of lysing virally-infected cells (*i.e.* cells pulsed with OSPF, target cells infected with vaccinia expressing HIV genes and target cells pulsed with virus-specific epitopic peptide P7G (AMQMLKETI) (SEQ ID NO:207)). Thus, since OSPF(s) are capable of generating a Th proliferative response 30 and CTLs in genetically diverse individuals/animals, there is no need to identify specific CTL epitopes.

2. Example 2: RSV

A. Materials and Methods

Potential OSPFs corresponding to RSV fusion protein (SEQ ID NO:214) are  
5 shown as follows (The numbered and underlined sequences represent the single chain  
peptide sequences):

	MELLILKANA ITTILTAVTF CFASGQNITE EFYQSTCSAV SKGYLSALRT
10	<u>GWYTSVITIE LSNIKENKCN GTDAKVLIK QELDKYKNAV TELQLLMQST</u>
	1                    2                    3
	<u>PPTNNRARRE LPRFMNYTLN NAKKTNVTLS KKRKRRFLGF LLGVGSAIAS</u>
	4                    5                    6                    7                    8
15	<u>GVAVSKVLHL EGEVNKIKSA LLSTNKAVVS LSNGSVLTS KVLDLKNYID</u>
	9                    10                    11                    12                    13
	<u>KQLLPIVNKQ SCSISNIETV IEFQOKNNRL LEITREFSVN AGVTTPVSTY</u>
	14                    15                    16                    17                    18
20	<u>MLTNSELLSSL INDMPITNDO KKLMMSNNVQI VRQQSYSIM SIIKEEVLAYV</u>
	19                    20                    21                    22                    23
	<u>VQLPLYGVI DTPCWKLHTSP LCTTNTKEGS NICLRTDRG WYCDNAGSVS</u>
	24                    25                    26                    27                    28
25	<u>FFPQAETCKV QSNRVFCDTM NSLTLPEIN LCNVDIFNPK YDCKIMTSKT</u>
	29                    30                    31                    32                    33
	<u>DVSSSVITSL GAIVSCYGKT KCTASNKNRG IIKTFNSNGCD YVSNKGMDTV</u>
	34                    35                    36                    37                    38
30	<u>SVGNTLYYVN KQEGKSLYYVK GEPIINFYDP LVFPSDEFDA SISQVNEKIN</u>
	39                    40                    41                    42                    43
	<u>QSLAFIRKSD ELLHNVNAGK STTNIMITTI IIVIIVILLS LIAVGLLLTC</u>
	44                    45                    46                    47                    48
	<u>KARSTPVTLS KDQLSGINNI AFSN</u>
	49                    50                    51                    52                    53
	54                    55 (13mer)

The OSPFs corresponding to the RSV fusion protein represent a group of 55 peptides of 15 amino acids in length, with 5 amino acid overlaps between sequential peptides, and spanning the entire RSV fusion protein.

Examples of other proteins of interest which can be used in the present invention, include, but are not limited to, anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG protein (SEQ ID NO:216); HIV-2

envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218);  
HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2  
(SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef  
protein (SEQ ID NO:222); circumsporozoite protein precursor (SEQ ID NO:223);  
5 circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID  
NO:225); S. aureus enterotoxin A (SEQ ID NO:226); E. coli enterotoxin A (SEQ ID  
NO:227); C. difficile enterotoxin A (SEQ ID NO:228); B. cereus enterotoxin A (SEQ  
ID NO:229); pertussis toxin subunit 3 (SEQ ID NO:230 ); SARS coronavirus  
(Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion  
10 protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233);  
coronavirus nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus  
(Frankfurt 1) spike protein S (SEQ ID NO: 235).

B. Vaccinia Viruses  
15 Vaccinia viruses expressing RSV fusion protein may be utilized and can be  
made using routine techniques known to those skilled in the art to conduct CTL  
assays *in vitro*.

C. Mice and Immunization  
20 BALB/c (H-2<sup>d</sup>) and C57BL/6 (H-2<sup>b</sup>) are immunized subcutaneously (s.c.) with  
OSPF of RSV fusion protein at 5 µg of each individual peptide per mouse together  
with MLP + TDM Adjuvant system (Sigma, St. Louis, MO; product number M6536.  
Peptides were >80% pure). Control mice are given only the adjuvant (mock  
immunization) according to the regimen described in Example 1.

25 D. Blood Donors and Isolation and Differentiation of Blood Dendritic Cells  
Leukopacks may be provided by anonymous, normal blood donors. These  
donors are MHC tissue-typed and dendritic cells isolated and differentiated as  
previously described above in Example 1.

E. Cytotoxic T Lymphocyte (CTL) Assays

Murine CTL Assays:

For the mouse CTL assay, effector cells are splenic mononuclear cells which are isolated from OSPF- or adjuvant-only immunized mice and restimulated (2 x 5  $10^6$ /ml) in vitro with 1  $\mu$ M peptide for 7-10 days. Target cells are P815 cells (H-2<sup>d</sup>, for BALB/c mice) and EL-4 cells (H-2<sup>b</sup>, for B57BL/6 mice). Target cells are labeled with <sup>51</sup>Cr (70  $\mu$ Ci/2 x  $10^6$  cells; Perkin-Elmer, Boston, MA) and pulsed overnight with or without OSPF-RSV fusion protein (1  $\mu$ M), or infected overnight with vaccinia virus [2 plaque forming unit (pfu)/target cell].

10 Effector cells and target cells are co-cultured at different ratios for 6 h, and cytolysis is determined by <sup>51</sup>Cr release from target cells (see, e.g., Wunderlich *et al.*, (1997) Current Protocols in Immunology 3.11.1-3.11.20). The percentage specific <sup>51</sup>Cr release is calculated as: 100 (experimental release – spontaneous release)/(maximum release – spontaneous release). Maximum release is determined from 15 supernatants of cells that are lysed by addition of 5% Triton-X 100. Spontaneous release is determined from the target cells incubated without addition of effector cells.

Human CTL Assays:

For the human CTL assay, effector cells are PBMC stimulated with irradiated 20 autologous DC that are pulsed with or without OSPF (see Table 2). Target cells are EBV-transformed, autologous B cell lines. These cells are labeled with <sup>51</sup>Cr (70  $\mu$ Ci/2 x  $10^6$  cells; Perkin-Elmer, Boston, MA) and pulsed overnight with or without OSPF RSV fusion protein (1  $\mu$ M), or infected overnight with vaccinia virus [2 plaque forming unit (pfu)/target cell] expressing SIV gag-pol-env, or wild type vaccinia virus 25 (Vaccinia virus expressing SIV gag-pol-env and wild type vaccinia virus are obtained from Therion, Cambridge, MA).

Effectors cells and target cells are co cultured and the percentage specific <sup>51</sup>Cr release is calculated as described above in the mouse CTL assay section (see, e.g., Wunderlich, *et al.*, *supra*).  
30

F. ELISPOT<sup>TM</sup> Assay

Human and mouse ELISPOT assays are performed using ELISPOT kits from BioSource International (Camarillo, CA). Briefly, following the final stimulation,

mouse splenocytes or human PBMC are stimulated with DC (treated with OSPF and untreated) and seeded into anti-interferon gamma (anti-IFN- $\gamma$ ) monoclonal antibody coated 96-well plates and incubated overnight at 4°C. Subsequently, the cells are discarded and biotinylated- anti-IFN- $\gamma$  antibodies are added for an hour at 37°C  
5 followed by another hour of incubation at 37°C with anti-biotin antibody labeled with enzyme. After the color reaction develops, spots are counted under a microscope. Results are expressed as spot forming units (SFU)/10<sup>6</sup> cells.

G. Lymphocyte Proliferation Assay

10 Splenic lymphocytes are isolated and cultured at 2 x 10<sup>6</sup> / ml in RPMI 1640 plus 15 % FCS plus antibiotics in the presence of RSV fusion protein (15 ug/ml) or OSPF-RSV fusion protein or ovalbumin (OVA) for 5 days. Four hours before harvesting, cells are pulsed with 1 uCi per well of <sup>3</sup>H-thymidine. After cells are harvested, <sup>3</sup>H-thymidine incorporation is assessed using a  $\beta$ -counter (Beckman).  
15 Results are expressed as count per minute (cpm).

Incorporation by Reference

20 The contents of all references (including literature references, issued patents, published patent applications, and co-pending patent applications) cited throughout this application are hereby expressly incorporated herein in their entireties by reference.

Equivalents

25 Those skilled in the art will recognize, or be able to ascertain using no more than routine experimentation, many equivalents of the specific embodiments of the invention described herein. Such equivalents are intended to be encompassed by the following claims.

30

CLAIMS

1. A method of modulating an immune response comprising administering to a subject an effective amount of an overlapping synthetic peptide formulation (OSPF), wherein said OSPF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptide is a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein at least one single chain peptide overlaps with another single chain peptide by a length represented by Z, wherein Z is 1 to (Y-1), wherein said length of said single chain peptide is such that internalization of said single chain peptide by a MHC-bearing cell and presentation by a MHC molecule to a T cell is possible, such that said immune response is modulated.
- 15 2. The method of claim 1, wherein said subject is a vertebrate.
3. The method of claim 1, wherein said Y is fifteen (15) amino acids.
4. The method of claim 1, wherein said Z is five (5) amino acids.
- 20 5. The method of claim 1, wherein said immune response is a Th1-mediated immune response.
6. The method of claim 5, wherein said Th1-mediated immune response is a CTL-mediated immune response.
- 25 7. The method of claim 1, wherein said immune response is a Th2-mediated immune response.
- 30 8. The method of claim 7, wherein said Th2-mediated immune response is an antibody-associated immune response.

9. The method of claim 1, wherein said MHC-bearing cell is a MHC Class I-bearing cell.

10. The method of claim 9, wherein said MHC Class I-bearing cell is a CTL.

5

11. The method of claim 1, wherein said MHC-bearing cell is a MHC Class II-bearing cell.

12. The method of claim 11, wherein said MHC Class II-bearing cell is a B cell.

10

13. The method of claim 1, wherein said protein of interest is selected from the group consisting of HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus

15 (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219);

20 HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); S. aureus enterotoxin A (SEQ ID

25 NO:226); E. coli enterotoxin A (SEQ ID NO:227); C. difficile enterotoxin A (SEQ ID NO:228); B. cereus enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ ID NO:230); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235).

30

14. A method of modulating an immune response comprising administering to a subject an effective amount of an overlapping synthetic peptide formulation (OSPF),

wherein said OSPF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein said length of said single chain  
5 peptides is such that internalization of said single chain peptide by a MHC-bearing cell and presentation by a MHC molecule to a T cell is possible, such that said immune response is modulated.

15. The method of claim 14, wherein said subject is a vertebrate.

10

16. The method of claim 14, wherein said Y is fifteen (15) amino acids.

17. The method of claim 14, wherein said immune response is a Th1-mediated immune response.

15

18. The method of claim 17, wherein said Th1-mediated immune response is a CTL-mediated immune response.

20

19. The method of claim 14, wherein said immune response is a Th2-mediated immune response.

20. The method of claim 19, wherein said Th2-mediated immune response is an antibody-associated immune response.

25

21. The method of claim 13, wherein said MHC-bearing cell is a MHC Class I-bearing cell.

22. The method of claim 21, wherein said MHC Class I-bearing cell is a CTL.

30

23. The method of claim 14, wherein said MHC-bearing cell is a MHC Class II-bearing cell.

24. The method of claim 23, wherein said MHC Class II-bearing cell is a B cell.

25. The method of claim 14, wherein said protein of interest is selected from the group consisting of HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); *S. aureus* enterotoxin A (SEQ ID NO:226); *E. coli* enterotoxin A (SEQ ID NO:227); *C. difficile* enterotoxin A (SEQ ID NO:228); *B. cereus* enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ ID NO:230)); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235).

26. A pharmaceutical composition comprising an overlapping synthetic peptide formulation (OSPF) and a pharmaceutically acceptable carrier, wherein said OSPF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptide is a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein at least one single chain peptide overlaps with another single chain peptide by a length represented by Z, wherein Z is 1 to (Y-1), wherein said length of said single chain peptide is such that internalization of said single chain peptide by a MHC-bearing cell and presentation by a MHC molecule to a T cell is possible.

27. The pharmaceutical composition of claim 26, wherein said Y is fifteen (15) amino acids.

5      28. The pharmaceutical composition of claim 27, wherein said Z is five (5) amino acids.

29. The pharmaceutical composition of claim 26, wherein said MHC-bearing cell is a MHC Class I-bearing cell.

10     30. The pharmaceutical composition of claim 29, wherein said MHC Class I-bearing cell is a CTL.

15     31. The pharmaceutical composition of claim 26, wherein said MHC-bearing cell is a MHC Class II-bearing cell.

32. The pharmaceutical composition of claim 31, wherein said MHC Class II-bearing cell is a B cell.

20     33. The pharmaceutical composition of claim 26, wherein said protein of interest is selected from the group consisting of HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); S. aureus enterotoxin A (SEQ ID NO:226); E. coli enterotoxin A (SEQ ID NO:227); C. difficile

25    

30

enterotoxin A (SEQ ID NO:228); B. cereus enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ ID NO:230); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus 5 nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235).

34. A pharmaceutical composition comprising an overlapping synthetic peptide 10 formulation (OSPF) and a pharmaceutically acceptable carrier, wherein said OSPF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein said length of said single chain peptides is such 15 that internalization of said single chain peptide by a MHC -bearing cell and presentation by a MHC molecule to a T cell is possible.

35. The pharmaceutical composition of claim 13, wherein said Y is fifteen (15) amino acids. 20

36. The pharmaceutical composition of claim 34, wherein said MHC-bearing cell is a MHC Class I-bearing cell. 25

37. The pharmaceutical composition of claim 36, wherein said MHC Class I-bearing cell is a CTL. 30

38. The pharmaceutical composition of claim 34, wherein said MHC-bearing cell is a MHC Class II-bearing cell.

39. The pharmaceutical composition of claim 38, wherein said MHC Class II-bearing cell is a B cell.

40. The pharmaceutical composition of claim 34, wherein said protein of interest is selected from the group consisting of HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); *S. aureus* enterotoxin A (SEQ ID NO:226); *E. coli* enterotoxin A (SEQ ID NO:227); *C. difficile* enterotoxin A (SEQ ID NO:228); *B. cereus* enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ ID NO:230 ); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235).

41. A method of treating an OSPF-associated disorder in a subject comprising administering to a subject an effective amount of an overlapping synthetic peptide formulation (OSPF), wherein said OSPF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptide is a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, and wherein at least one single chain peptide overlaps with another single chain peptide by a length of Z, wherein Z is 1 to (Y-1), wherein said length of said single chain peptide is such that internalization of said single chain peptide by a MHC-bearing cell and presentation by a MHC molecule to a T cell is possible, such that said OSPF-associated disorder is treated in said subject.

42. The method of claim 41, wherein said subject is a vertebrate.

5      43. The method of claim 41, wherein said Y is fifteen (15) amino acids.

10     44. The method of claim 41, wherein said Z is five (5) amino acids.

15     45. The method of claim 41, wherein said MHC-bearing cell is a MHC Class I-bearing cell.

20     46. The method of claim 45, wherein said MHC Class I-bearing cell is a CTL.

25     47. The method of claim 45, wherein said MHC-bearing cell is a MHC Class II-bearing cell.

30     48. The method of claim 47, wherein said MHC Class II-bearing cell is a B cell.

49. The method of claim 41, wherein said protein of interest is selected from the group consisting of HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); *S. aureus* enterotoxin A (SEQ ID NO:226); *E. coli* enterotoxin A (SEQ ID NO:227); *C. difficile* enterotoxin A (SEQ ID NO:228); *B. cereus* enterotoxin A (SEQ ID NO:229);

5 pertussis toxin subunit 3 (SEQ ID NO:230); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235).

10 50. The method of claim 41, wherein said OSPF-associated disorder is a viral infection due to a virus.

15 51. The method of claim 50, wherein said virus is selected from the group consisting of HIV, *e.g.*, HIV-1 and HIV-2, human herpes viruses, cytomegalovirus ((esp. Human), Rotavirus, Epstein-Barr virus, Varicella Zoster Virus, hepatitis viruses, such as hepatitis B virus, hepatitis A virus, hepatitis C virus and hepatitis E virus, paramyxoviruses: Respiratory Syncytial virus, parainfluenza virus, Ebola virus, measles virus, mumps virus, human papilloma viruses (for example HPV6, 11, 16, 18 and the like), flaviviruses (*e.g.* Yellow Fever Virus, Dengue Virus, Tick-borne encephalitis virus, Japanese Encephalitis Virus) or influenza virus.

20 52. The method of claim 51, wherein said virus is Ebola virus.

25 53. The method of claim 49, wherein said protein of interest is Ebola virus nucleoprotein (SEQ ID NO:210).

54. The method of claim 41, wherein said OSPF-associated disorder is a bacterial infection due to a bacteria.

30 55. The method of claim 54, wherein said bacteria is selected from the group consisting of N. gonorrhoea and N. meningitidis, Streptococcus spp, including S. pneumoniae, S. pyogenes, S. agalactiae, S. mutans; Haemophilus spp, including H. influenzae type B, non typeable H. influenzae, H. ducreyi; Moraxella spp, including M catarrhalis, also known as Branhamella catarrhalis; Bordetella spp, including B. pertussis, B. parapertussis and B. bronchiseptica; Mycobacterium spp., including M. tuberculosis, M. bovis, M. leprae, M. avium, M. paratuberculosis, M. smegmatis;

Legionella spp, including L. pneumophila; Escherichia spp, including enterotoxic E. coli, enterohemoragic E. coli, enteropathogenic E. coli; Vibrio spp, including V. cholera, Shigella spp, including S. sonnei, S. dysenteriae, S. flexnerii; Yersinia spp, including Y. enterocolitica, Y. pestis, Y. pseudotuberculosis, Campylobacter spp,  
5 including C. jejuni and C. coli; Salmonella spp, including S. typhi, S. paratyphi, S. choleraesuis, S. enteritidis; Listeria spp., including L. monocytogenes; Helicobacter spp, including H. pylori; Pseudomonas spp, including P. aeruginosa, Staphylococcus spp., including S. aureus, S. epidermidis; Enterococcus spp., including E. faecalis, E. faecium; Clostridium spp., including C. tetani, C. botulinum, C. difficile; Bacillus spp., including B. anthracis; Corynebacterium spp., including C. diphtheriae; Borrelia spp., including B. burgdorferi, B. garinii, B. afzelii, B. andersonii, B. hermsii; Ehrlichia spp., including E. equi and the agent of the Human Granulocytic Ehrlichiosis; Rickettsia spp, including R. rickettsii; Chlamydia spp., including C. trachomatis, C. neumoniae, C. psittaci; Leptira spp., including L. interrogans;  
10 15 Treponema spp., including T. pallidum, T. denticola, T. hyodysenteriae.

56. The method of claim 55, wherein said bacteria is B. anthracis.

57. The method of claim 49, wherein said protein of interest is anthrax toxins  
20 translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209).

58. The method of claim 41, wherein said OSPF-associated disorder is a neoplastic disease.

25 59. The method of claim 58, wherein said neoplastic disease is selected from the group consisting of breast, colon, non-small cell lung, head and neck, colorectal, lung, prostate, ovary, renal, melanoma, gastrointestinal cancer and osteogenic sarcoma.

60. The method of claim 59, wherein said neoplastic disease is melanoma.

30 61. The method of claim 49, wherein said protein of interest is melanoma antigen p15 (SEQ ID NO:212).

62. The method of claim 41, wherein said OSPF-associated disorder is a state of toxicity due to a toxin.

5       63. The method of claim 62, wherein said toxin is selected from the group consisting of botulin, perfringens toxin, pertussis, mycotoxins, shigatoxins, staphylococcal enterotoxin B, tetanus, ricin, cholera, aflatoxins, diphtheria, T2, seguitoxin, saxitoxin, abrin, cyanoginosin, alphatoxin, tetrodotoxin, aconotoxin, snake venom, scorpion venom and spider venoms.

10      64. The method of claim 62, wherein said toxin is pertussis.

65. The method of claim 49, wherein said protein of interest is pertussis toxin subunit 3 (SEQ ID NO:230).

15      66. The method of claim 41, wherein said OSPF-associated disorder is a parasitic infection due to a parasite.

20      67. The method of claim 66, wherein said parasite is selected from the group consisting of Anaplasma, Babesia, Balantidium, Besnoitia, Chlamydia, Coccidia, Cryptosodium, Cytauxzoon, Eimeria Entamoeba, Eperythrozoon, Erlichia, Giardia, Haemobartonella, Hammondia, Isopora, Leishmania, Neorickettsia, Plasmodium, Pneumocystis, Rickettsia, Schistosoma, Sarcocystis, Theileria, Thrichinella, Toxoplasma, Trichomonas, Trypanosoma, Unicaria, Dipylidium, Echinococcuse, Taenia, Ancylostoma, Ascaris, Enterobius, Strongyloides, Strongylus, Toxocara, 25     Toxascaris and Trichuris.

68. The method of claim 67, wherein said parasite is Plasmodium.

30      69. The method of claim 49, wherein said protein of interest is circumsporozoite protein II (SEQ ID NO:224).

70. A method of treating an OSPF-associated disorder in a subject comprising administering to a subject an effective amount of an overlapping synthetic peptide formulation (OSPF), wherein said OSPF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein said length of said single chain peptides is such that internalization of said single chain peptide by a MHC -bearing cell and presentation by a MHC molecule to a T cell is possible, such that said OSPF-associated disorder is treated in said subject.

10

71. The method of claim 70, wherein said subject is a vertebrate.

15 72. The method of claim 70, wherein said Y is fifteen (15) amino acids.

73. The method of claim 70, wherein said MHC-bearing cell is a MHC Class I-bearing cell.

20 74. The method of claim 73, wherein said MHC Class I-bearing cell is a CTL.

75. The method of claim 70, wherein said MHC-bearing cell is a MHC Class II-bearing cell.

25 76. The method of claim 75, wherein said MHC Class II-bearing cell is a B cell.

77. The method of claim 70, wherein said protein of interest is selected from the group consisting of HIV Gag (SEQ ID NO:339); SIV Envelope protein (SEQ ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA])

30 (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG

protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); S. aureus enterotoxin A (SEQ ID NO:226); E. coli enterotoxin A (SEQ ID NO:227); C. difficile enterotoxin A (SEQ ID NO:228); B. cereus enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ ID NO:230) ); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235).

78. The method of claim 70, wherein said OSPF-associated disorder is a viral infection due to a virus.

79. The method of claim 78, wherein said virus is selected from the group consisting of HIV, *e.g.*, HIV-1 and HIV-2, human herpes viruses, cytomegalovirus (esp. Human), Rotavirus, Epstein-Barr virus, Varicella Zoster Virus, hepatitis viruses, such as hepatitis B virus, hepatitis A virus, hepatitis C virus and hepatitis E virus, paramyxoviruses: Respiratory Syncytial virus, parainfluenza virus, Ebola virus, measles virus, mumps virus, human papilloma viruses (for example HPV6, 11, 16, 18 and the like), flaviviruses (*e.g.* Yellow Fever Virus, Dengue Virus, Tick-borne encephalitis virus, Japanese Encephalitis Virus) or influenza virus.

25

80. The method of claim 79, wherein said virus is Ebola virus.

81. The method of claim 77, wherein said protein of interest is Ebola virus nucleoprotein (SEQ ID NO:210).

30

82. The method of claim 70, wherein said OSPF-associated disorder is a bacterial infection due to a bacteria.

83. The method of claim 82, wherein said bacteria is selected from the group consisting of *N. gonorrhoea* and *N. meningitidis*, *Streptococcus* spp, including *S. pneumoniae*, *S. pyogenes*, *S. agalactiae*, *S. mutans*; *Haemophilus* spp, including *H. influenzae* type B, non typeable *H. influenzae*, *H. ducreyi*; *Moraxella* spp, including  
5 *M catarrhalis*, also known as *Branhamella catarrhalis*; *Bordetella* spp, including *B. pertussis*, *B. parapertussis* and *B. bronchiseptica*; *Mycobacterium* spp., including *M. tuberculosis*, *M. bovis*, *M. leprae*, *M. avium*, *M. paratuberculosis*, *M. smegmatis*; *Legionella* spp, including *L. pneumophila*; *Escherichia* spp, including enterotoxic *E. coli*, enterohemoragic *E. coli*, enteropathogenic *E. coli*; *Vibrio* spp, including *V. cholera*, *Shigella* spp, including *S. sonnei*, *S. dysenteriae*, *S. flexnerii*; *Yersinia* spp, including *Y. enterocolitica*, *Y. pestis*, *Y. pseudotuberculosis*, *Campylobacter* spp, including *C. jejuni* and *C. coli*; *Salmonella* spp, including *S. typhi*, *S. paratyphi*, *S. choleraesuis*, *S. enteritidis*; *Listeria* spp., including *L. monocytogenes*; *Helicobacter* spp, including *H. pylori*; *Pseudomonas* spp, including *P. aeruginosa*, *Staphylococcus* spp., including *S. aureus*, *S. epidermidis*; *Enterococcus* spp., including *E. faecalis*, *E. faecium*; *Clostridium* spp., including *C. tetani*, *C. botulinum*, *C. difficile*; *Bacillus* spp., including *B. anthracis*; *Corynebacterium* spp., including *C. diphtheriae*; *Borrelia* spp., including *B. burgdorferi*, *B. garinii*, *B. afzelii*, *B. andersonii*, *B. hermsii*; *Ehrlichia* spp., including *E. equi* and the agent of the Human Granulocytic  
10 *Ehrlichiosis*; *Rickettsia* spp, including *R. rickettsii*; *Chlamydia* spp., including *C. trachomatis*, *C. neumoniae*, *C. psittaci*; *Leptira* spp., including *L. interrogans*; *Treponema* spp., including *T. pallidum*, *T. denticola*, *T. hyodysenteriae*.

84. The method of claim 83, wherein said bacteria is *B. anthracis*.

25

85. The method of claim 77, wherein said protein of interest is anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209).

30

86. The method of claim 70, wherein said OSPF-associated disorder is a neoplastic disease.

87. The method of claim 86, wherein said neoplastic disease is selected from the group consisting of breast, colon, non-small cell lung, head and neck, colorectal, lung, prostate, ovary, renal, melanoma, gastrointestinal cancer and osteogenic sarcoma.

5 88. The method of claim 87, wherein said neoplastic disease is melanoma.

89. The method of claim 77, wherein said protein of interest melanoma antigen p15 (SEQ ID NO:212).

10 90. The method of claim 70, wherein said OSPF-associated disorder is a state of toxicity due to a toxin.

15 91. The method of claim 90, wherein said toxin is selected from the group consisting of botulin, perfringens toxin, pertussis, mycotoxins, shigatoxins, staphylococcal enterotoxin B, tetanus, ricin, cholera, aflatoxins, diphtheria, T2, seguitoxin, saxitoxin, abrin, cyanoginosin, alphatoxin, tetrodotoxin, aconotoxin, snake venom, scorpion venom and spider venoms.

92. The method of claim 91, wherein said toxin is pertussis.

20 93. The method of claim 77, wherein said protein of interest is pertussis toxin subunit 3 (SEQ ID NO:230).

25 94. The method of claim 70, wherein said OSPF-associated disorder is a parasitic infection due to a parasite.

30 95. The method of claim 94, wherein said parasite is selected from the group consisting of Anaplasma, Babesia, Balantidium, Besnoitia, Chlamydia, Coccidia, Cryptospondium, Cytauxzoon, Eimeria Entamoeba, Eperythrozoon, Erlichia, Giardia, Haemobartonella, Hammondia, Isopora, Leishmania, Neorickettsia, Plasmodium, Pneumocystis, Rickettsia, Schistosoma, Sarcocystis, Theileria, Thrichinella, Toxoplasma, Trichomonas, Trypanosoma, Unicaria, Dipylidium, Echinococcuse,

Taenia, Ancylostoma, Ascaris, Enterobius, Strongyloides, Strongylus, Toxocara, Toxascaris and Trichuris.

96. The method of claim 95, wherein said parasite is Plasmodium.

5

97. The method of claim 77, wherein said protein of interest is circumsporozoite protein II (SEQ ID NO:224).

98. A vaccine for immunizing a subject against an OSPF-associated disorder by  
10 modulating a CTL-mediated immune response comprising a pharmaceutically  
acceptable carrier and an overlapping synthetic peptide formulation (OSPF), wherein  
said OSPF comprises a combination of single chain peptides corresponding to an  
amino acid sequence of a protein of interest, wherein said single chain peptide is a  
length represented by Y, wherein Y at least 7 to (X-1) and X is the number of amino  
15 acids of said protein of interest, and wherein at least one single chain peptide overlaps  
with another single chain peptide by a length represented by Z, wherein Z is 1 to (Y-  
1), wherein said length of said single chain peptide is such that internalization of said  
single chain peptide by a MHC-bearing cell and presentation by a MHC molecule to a  
T cell is possible.

20

99. The vaccine of claim 98, wherein said subject is a vertebrate.

100. The vaccine of claim 98, wherein said Y is fifteen (15) amino acids.

25

101. The vaccine of claim 98, wherein said Z is five (5) amino acids.

102. The vaccine of claim 98, wherein said MHC-bearing cell is a MHC Class I-  
bearing cell.

30

103. The vaccine of claim 102, wherein said MHC Class I-bearing cell is a CTL.

104. The vaccine of claim 98, wherein said MHC-bearing cell is a MHC Class II-  
bearing cell.

105. The vaccine of claim 104, wherein said MHC Class II-bearing cell is a B cell.

106. The vaccine of claim 98, wherein said protein of interest is selected from the  
5 group consisting of HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ  
ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA])  
(SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus  
(HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212);  
human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion  
10 protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG  
protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1  
vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219);  
HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ  
ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein  
15 precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224);  
pertussis-like toxin subunit (SEQ ID NO:225); S. aureus enterotoxin A (SEQ ID  
NO:226); E. coli enterotoxin A (SEQ ID NO:227); C. difficile enterotoxin A (SEQ ID  
NO:228); B. cereus enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ  
ID NO:230) ); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231);  
20 Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus  
matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO:  
234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235).

25 107. The vaccine of claim 98, wherein said OSPF-associated disorder is a viral  
infection due to a virus.

108. The vaccine of claim 107, wherein said virus is selected from the group  
consisting of HIV, *e.g.*, HIV-1 AND HIV-2, human herpes viruses, cytomegalovirus  
30 (esp. Human), Rotavirus, Epstein-Barr virus, Varicella Zoster Virus, hepatitis viruses,  
such as hepatitis B virus, hepatitis A virus, hepatitis C virus and hepatitis E virus,  
paramyxoviruses: Respiratory Syncytial virus, parainfluenza virus, Ebola virus,  
measles virus, mumps virus, human papilloma viruses (for example HPV6, 11, 16, 18

and the like), flaviviruses (*e.g.* Yellow Fever Virus, Dengue Virus, Tick-borne encephalitis virus, Japanese Encephalitis Virus) or influenza virus..

109. The vaccine of claim 108, wherein said virus is Ebola virus.

5

110. The vaccine of claim 105, wherein said protein of interest is Ebola virus nucleoprotein (SEQ ID NO:210).

10 111. The vaccine of claim 98, wherein said OSPF-associated disorder is a bacterial infection due to a bacteria.

112. The vaccine of claim 111, wherein said bacteria is selected from the group consisting of *N. gonorrhoea* and *N. meningitidis*, *Streptococcus* spp, including *S. pneumoniae*, *S. pyogenes*, *S. agalactiae*, *S. mutans*; *Haemophilus* spp, including *H. influenzae* type B, non typeable *H. influenzae*, *H. ducreyi*; *Moraxella* spp, including *M catarrhalis*, also known as *Branhamella catarrhalis*; *Bordetella* spp, including *B. pertussis*, *B. parapertussis* and *B. bronchiseptica*; *Mycobacterium* spp., including *M. tuberculosis*, *M. bovis*, *M. leprae*, *M. avium*, *M. paratuberculosis*, *M. smegmatis*; *Legionella* spp, including *L. pneumophila*; *Escherichia* spp, including enterotoxic *E. coli*, enterohemorragic *E. coli*, enteropathogenic *E. coli*; *Vibrio* spp, including *V. cholera*, *Shigella* spp, including *S. sonnei*, *S. dysenteriae*, *S. flexnerii*; *Yersinia* spp, including *Y. enterocolitica*, *Y. pestis*, *Y. pseudotuberculosis*, *Campylobacter* spp, including *C. jejuni* and *C. coli*; *Salmonella* spp, including *S. typhi*, *S. paratyphi*, *S. choleraesuis*, *S. enteritidis*; *Listeria* spp., including *L. monocytogenes*; *Helicobacter* spp, including *H. pylori*; *Pseudomonas* spp, including *P. aeruginosa*, *Staphylococcus* spp., including *S. aureus*, *S. epidermidis*; *Enterococcus* spp., including *E. faecalis*, *E. faecium*; *Clostridium* spp., including *C. tetani*, *C. botulinum*, *C. difficile*; *Bacillus* spp., including *B. anthracis*; *Corynebacterium* spp., including *C. diphtheriae*; *Borrelia* spp., including *B. burgdorferi*, *B. garinii*, *B. afzelii*, *B. andersonii*, *B. hermsii*; *30 Ehrlichia* spp., including *E. equi* and the agent of the Human Granulocytic Ehrlichiosis; *Rickettsia* spp, including *R. rickettsii*; *Chlamydia* spp., including *C. trachomatis*, *C. neumoniae*, *C. psittaci*; *Leptira* spp., including *L. interrogans*; *Treponema* spp., including *T. pallidum*, *T. denticola*, *T. hyoysenteriae*.

113. The vaccine of claim 112, wherein said bacteria is *B. anthracis*.

114. The vaccine of claim 105, wherein said protein of interest is anthrax toxins  
5 translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209).

115. The vaccine of claim 98, wherein said OSPF-associated disorder is a neoplastic disease.

10 116. The vaccine of claim 115, wherein said neoplastic disease is selected from the group consisting of breast, colon, non-small cell lung, head and neck, colorectal, lung, prostate, ovary, renal, melanoma, gastrointestinal cancer and osteogenic sarcoma.

15 117. The vaccine of claim 116, wherein said neoplastic disease is melanoma.

118. The vaccine of claim 117, wherein said protein of interest is melanoma antigen p15 (SEQ ID NO:212).

20 119. The vaccine of claim 98, wherein said OSPF-associated disorder is a state of toxicity due to a toxin.

120. The vaccine of claim 119, wherein said toxin is selected from the group consisting of botulin, perfringens toxin, pertussis, mycotoxins, shigatoxins, 25 staphylococcal enterotoxin B, tetanus, ricin, cholera, aflatoxins, diphtheria, T2, seguitoxin, saxitoxin, abrin, cyanoginosin, alphatoxin, tetrodotoxin, aconotoxin, snake venom, scorpion venom and spider venoms.

121. The vaccine of claim 120, wherein said toxin is pertussis.

30 122. The vaccine of claim 106, wherein said protein of interest is pertussis toxin subunit 3 (SEQ ID NO:230).

123. The method of claim 98, wherein said OSPF-associated disorder is a parasitic infection due to a parasite.

124. The method of claim 123, wherein said parasite is selected from the group consisting of Anaplasma, Babesia, Balantidium, Besnoitia, Chlamydia, Coccidia, Cryptospondium, Cytauxzoon, Eimeria Entamoeba, Eperythrozoon, Erlichia, Giardia, Haemobartonella, Hammondia, Isopora, Leishmania, Neorickettsia, Plasmodium, Pneumocystis, Rickettsia, Schistosoma, Sarcocystis, Theileria, Thrichinella, Toxoplasma, Trichomonas, Trypanosoma, Unicaria, Dipylidium, Echinococcus, 10 Taenia, Ancylostoma, Ascaris, Enterobius, Strongyloides, Strongylus, Toxocara, Toxascaris and Trichuris..

125. The method of claim 124, wherein said parasite is Plasmodium.

15 126. The method of claim 106, wherein said protein of interest is circumsporozoite protein II (SEQ ID NO:224).

127. A vaccine for immunizing a subject against an OSPF-associated disorder comprising a pharmaceutically acceptable carrier and an overlapping synthetic peptide formulation (OSPF), wherein said OSPF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein said length of said single chain peptides is such that internalization of said single chain peptide by a MHC -bearing cell and presentation by a MHC molecule to a T cell is possible. 20 25

128. The vaccine of claim 127, wherein said subject is a vertebrate.

30 129. The vaccine of claim 127, wherein said Y is fifteen (15) amino acids.

130. The vaccine of claim 127, wherein said MHC-bearing cell is a MHC Class I-bearing cell.

131. The vaccine of claim 130, wherein said MHC Class I-bearing cell is a CTL.
132. The vaccine of claim 127, wherein said MHC-bearing cell is a MHC Class II-bearing cell.
  133. The vaccine of claim 132, wherein said MHC Class II-bearing cell is a B cell.
  134. The vaccine of claim 127, wherein said protein of interest is selected from the group consisting of HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); *S. aureus* enterotoxin A (SEQ ID NO:226); *E. coli* enterotoxin A (SEQ ID NO:227); *C. difficile* enterotoxin A (SEQ ID NO:228); *B. cereus* enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ ID NO:230); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235).
135. The vaccine of claim 127, wherein said OSPF-associated disorder is a viral infection due to a virus.
136. The vaccine of claim 135, wherein said virus is selected from the group consisting of , HIV, e.g., HIV-1 and HIV-2, human herpes viruses, cytomegalovirus

(esp. Human), Rotavirus, Epstein-Barr virus, Varicella Zoster Virus, hepatitis viruses, such as hepatitis B virus, hepatitis A virus, hepatitis C virus and hepatitis E virus, paramyxoviruses: Respiratory Syncytial virus, parainfluenza virus, Ebola virus, measles virus, mumps virus, human papilloma viruses (for example HPV6, 11, 16, 18  
5 and the like), flaviviruses (e.g. Yellow Fever Virus, Dengue Virus, Tick-borne encephalitis virus, Japanese Encephalitis Virus) or influenza virus..

137. The vaccine of claim 136, wherein said virus is Ebola virus.

10 138. The vaccine of claim 134, wherein said protein of interest is Ebola virus nucleoprotein (SEQ ID NO:210).

139. The vaccine of claim 127, wherein said OSPF-associated disorder is a bacterial infection due to bacteria.

15 140. The vaccine of claim 139, wherein said bacteria is selected from the group consisting of N. gonorrhoea and N. meningitidis, Streptococcus spp, including S. pneumoniae, S. pyogenes, S. agalactiae, S. mutans; Haemophilus spp, including H. influenzae type B, non typeable H. influenzae, H. ducreyi; Moraxella spp, including M. catarrhalis, also known as Branhamella catarrhalis; Bordetella spp, including B. pertussis, B. parapertussis and B. bronchiseptica; Mycobacterium spp., including M. tuberculosis, M. bovis, M. leprae, M. avium, M. paratuberculosis, M. smegmatis; Legionella spp, including L. pneumophila; Escherichia spp, including enterotoxic E. coli, enterohemoragic E. coli, enteropathogenic E. coli; Vibrio spp, including V. cholera, Shigella spp, including S. sonnei, S. dysenteriae, S. flexnerii; Yersinia spp, including Y. enterocolitica, Y. pestis, Y. pseudotuberculosis, Campylobacter spp, including C. jejuni and C. coli; Salmonella spp, including S. typhi, S. paratyphi, S. choleraesuis, S. enteritidis; Listeria spp., including L. monocytogenes; Helicobacter spp, including H. pylori; Pseudomonas spp, including P. aeruginosa, Staphylococcus spp., including S. aureus, S. epidermidis; Enterococcus spp., including E. faecalis, E. faecium; Clostridium spp., including C. tetani, C. botulinum, C. difficile; Bacillus spp., including B. anthracis; Corynebacterium spp., including C. diphtheriae; Borrelia spp., including B. burgdorferi, B. garinii, B. afzelii, B. andersonii, B. hermsii;

Ehrlichia spp., including E. equi and the agent of the Human Granulocytic Ehrlichiosis; Rickettsia spp, including R. rickettsii; Chlamydia spp., including C. trachomatis, C. neumoniae, C. psittaci; Leptira spp., including L. interrogans; Treponema spp., including T. pallidum, T. denticola, T. hyodysenteriae.

5

141. The vaccine of claim 140, wherein said bacteria is B. anthracis.

142. The vaccine of claim 134, wherein said protein of interest is anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209).

10

143. The vaccine of claim 127, wherein said OSPF-associated disorder is a neoplastic disease.

15

144. The vaccine of claim 142, wherein said neoplastic disease is selected from the group consisting of breast, colon, non-small cell lung, head and neck, colorectal, lung, prostate, ovary, renal, melanoma, gastrointestinal cancer and osteogenic sarcoma.

145. The vaccine of claim 144, wherein said neoplastic disease is melanoma.

20

146. The vaccine of claim 134, wherein said protein of interest is melanoma antigen p15 (SEQ ID NO:212).

147. The vaccine of claim 127, wherein said OSPF-associated disorder is a state of toxicity due to a toxin.

25

148. The vaccine of claim 147, wherein said toxin is selected from the group consisting of botulin, perfringens toxin, pertussis, mycotoxins, shigatoxins, staphylococcal enterotoxin B, tetanus, ricin, cholera, aflatoxins, diphtheria, T2, seguitoxin, saxitoxin, abrin, cyanoginosin, alphatoxin, tetrodotoxin, aconotoxin, snake venom, scorpion venom and spider venoms.

149. The vaccine of claim 148, wherein said toxin is pertussis.

150. The vaccine of claim 134, wherein said protein of interest is pertussis toxin subunit 3 (SEQ ID NO:230).

151. The method of claim 127, wherein said OSPF-associated disorder is a parasitic  
5 infection due to a parasite.

152. The method of claim 151, wherein said parasite is selected from the group consisting of Anaplasma, Babesia, Balantidium, Besnoitia, Chlamydia, Coccidia, Cryptospondium, Cytauxzoon, Eimeria Entamoeba, Eperythrozoon, Erlichia, Giardia,  
10 Haemobartonella, Hammondia, Isopora, Leishmania, Neorickettsia, Plasmodium, Pneumocystis, Rickettsia, Schistosoma, Sarcocystis, Theileria, Thrichinella, Toxoplasma, Trichomonas, Trypanosoma, Unicaria, Dipylidium, Echinococcuse, Taenia, Ancylostoma, Ascaris, Enterobius, Strongyloides, Strongylus, Toxocara, Toxascaris and Trichuris.

15

153. The vaccine of claim 152, wherein said parasite is Plasmodium.

154. The method of claim 134, wherein said protein of interest is circumsporozoite protein II (SEQ ID NO:224).

20

155. A kit for immunizing a subject against an OSPF-associated disorder comprising the vaccine of any one of claims 98 or 127 and instructions for use.

25

156. A method of preventing an OSPF-associated disorder in a subject comprising administering to a subject an effective amount of an overlapping synthetic peptide formulation (OSPF), wherein said OSPF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptide is a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, and wherein at least  
30 one single chain peptide overlaps with another single chain peptide by a length of Z, wherein Z is 1 to (Y-1), wherein said length of said single chain peptide is such that internalization of said single chain peptide by a MHC-bearing cell and presentation by

a MHC molecule to a T cell is possible, such that said OSPF-associated disorder is prevented in said subject.

157. The method of claim 156, wherein said subject is a vertebrate.

5

158. The method of claim 156, wherein said Y is fifteen (15) amino acids.

159. The method of claim 156, wherein said Z is five (5) amino acids.

10 160. The method of claim 156, wherein said MHC-bearing cell is a MHC Class I-bearing cell.

161. The method of claim 160, wherein said MHC Class I-bearing cell is a CTL.

15 162. The method of claim 156, wherein said MHC-bearing cell is a MHC Class II-bearing cell.

163. The method of claim 162, wherein said MHC Class II-bearing cell is a B cell.

20 164. The method of claim 156, wherein said protein of interest is selected from the group consisting of HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212);  
25 human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ  
30 ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); S. aureus enterotoxin A (SEQ ID NO:226); E. coli enterotoxin A (SEQ ID NO:227); C. difficile enterotoxin A (SEQ ID

NO:228); B. cereus enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ ID NO:230) ); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO: 5 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235).

165. The method of claim 156, wherein said OSPF-associated disorder is a viral infection due to a virus.

10 166. The method of claim 165, wherein said virus is selected from the group consisting of HIV, *e.g.*, HIV-1 and HIV-2, human herpes viruses, cytomegalovirus (esp Human), Rotavirus, Epstein-Barr virus, Varicella Zoster Virus, hepatitis viruses, such as hepatitis B virus, hepatitis A virus, hepatitis C virus and hepatitis E virus, paramyxoviruses: Respiratory Syncytial virus, parainfluenza virus, Ebola virus, 15 measles virus, mumps virus, human papilloma viruses (for example HPV6, 11, 16, 18 and the like), flaviviruses (*e.g.* Yellow Fever Virus, Dengue Virus, Tick-borne encephalitis virus, Japanese Encephalitis Virus) or influenza virus..

167. The method of claim 166, wherein said virus is Ebola virus.

20 168. The method of claim 164, wherein said protein of interest is Ebola virus nucleoprotein (SEQ ID NO:210).

169. The method of claim 156, wherein said OSPF-associated disorder is a bacterial 25 infection due to a bacteria.

170. The method of claim 169, wherein said bacteria is selected from the group consisting of N. gonorrhoea and N. meningitidis, Streptococcus spp, including S. pneumoniae, S. pyogenes, S. agalactiae, S. mutans; Haemophilus spp, including H. 30 influenzae type B, non typeable H. influenzae, H. ducreyi; Moraxella spp, including M catarrhalis, also known as Branhamella catarrhalis; Bordetella spp, including B. pertussis, B. parapertussis and B. bronchiseptica; Mycobacterium spp., including M. tuberculosis, M. bovis, M. leprae, M. avium, M. paratuberculosis, M. smegmatis;

Legionella spp, including L. pneumophila; Escherichia spp, including enterotoxic E. coli, enterohemorragic E. coli, enteropathogenic E. coli; Vibrio spp, including V. cholera, Shigella spp, including S. sonnei, S. dysenteriae, S. flexnerii; Yersinia spp, including Y. enterocolitica, Y. pestis, Y. pseudotuberculosis, Campylobacter spp,  
5 including C. jejuni and C. coli; Salmonella spp, including S. typhi, S. paratyphi, S. choleraesuis, S. enteritidis; Listeria spp., including L. monocytogenes; Helicobacter spp, including H. pylori; Pseudomonas spp, including P. aeruginosa, Staphylococcus spp., including S. aureus, S. epidermidis; Enterococcus spp., including E. faecalis, E. faecium; Clostridium spp., including C. tetani, C. botulinum, C. difficile; Bacillus spp., including B. anthracis; Corynebacterium spp., including C. diphtheriae; Borrelia spp., including B. burgdorferi, B. garinii, B. afzelii, B. andersonii, B. hermsii; Ehrlichia spp., including E. equi and the agent of the Human Granulocytic Ehrlichiosis; Rickettsia spp, including R. rickettsii; Chlamydia spp., including C. trachomatis, C. neumoniae, C. psittaci; Leptira spp., including L. interrogans;  
10 15 Treponema spp., including T. pallidum, T. denticola, T. hyodysenteriae.

171. The method of claim 170, wherein said bacteria is B. anthracis.

172. The method of claim 164, wherein said protein of interest is anthrax toxins  
20 translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209).

173. The method of claim 156, wherein said OSPF-associated disorder is a neoplastic disease.

25 174. The method of claim 173, wherein said neoplastic disease is selected from the group consisting of breast, colon, non-small cell lung, head and neck, colorectal, lung, prostate, ovary, renal, melanoma, gastrointestinal cancer and osteogenic sarcoma.

175. The method of claim 174, wherein said neoplastic disease is melanoma.

30 176. The method of claim 164, wherein said protein of interest is melanoma antigen p15 (SEQ ID NO:212);

177. The method of claim 156, wherein said OSPF-associated disorder is a state of toxicity due to a toxin.

178. The method of claim 177, wherein said toxin is selected from the group consisting of botulin, perfringens toxin, pertussis, mycotoxins, shigatoxins, staphylococcal enterotoxin B, tetanus, ricin, cholera, aflatoxins, diphtheria, T2, seguitoxin, saxitoxin, abrin, cyanoginosin, alphatoxin, tetrodotoxin, aconotoxin, snake venom, scorpion venom and spider venoms.

10 179. The method of claim 178, wherein said toxin is pertussis.

180. The method of claim 164, wherein said protein of interest is pertussis toxin subunit 3 (SEQ ID NO:230).

15 181. The method of claim 156, wherein said OSPF-associated disorder is a parasitic infection due to a parasite.

182. The method of claim 181, wherein said parasite is selected from the group consisting of Anaplasma, Babesia, Balantidium, Besnoitia, Chlamydia, Coccidia, 20 Cryptospondium, Cytauxzoon, Eimeria Entamoeba, Eperythrozoon, Erlichia, Giardia, Haemobartonella, Hammondia, Isopora, Leishmania, Neorickettsia, Plasmodium, Pneumocystis, Rickettsia, Schistosoma, Sarcocystis, Theileria, Thrichinella, Toxoplasma, Trichomonas, Trypanosoma, Unicaria, Dipylidium, Echinococcuse, Taenia, Ancylostoma, Ascaris, Enterobius, Strongyloides, Strongylus, Toxocara, 25 Toxascaris and Trichuris.

183. The method of claim 182, wherein said parasite is Plasmodium.

184. The method of claim 164, wherein said protein of interest is circumsporozoite 30 protein II (SEQ ID NO:224).

185. A method of preventing an OSPF-associated disorder in a subject comprising administering to a subject an effective amount of an overlapping synthetic peptide

formulation (OSPF), wherein said OSPF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein said length of said single chain peptides is such that internalization of said single chain peptide by a MHC -bearing cell and presentation by a MHC molecule to a T cell is possible, such that said OSPF-associated disorder is prevented in said subject.

186. The method of claim 185, wherein said subject is a vertebrate.

10

187. The method of claim 185, wherein said Y is fifteen (15) amino acids.

188. The method of claim 185, wherein said MHC-bearing cell is a MHC Class I-bearing cell.

15

189. The method of claim 188, wherein said MHC Class I-bearing cell is a CTL.

190. The method of claim 185, wherein said MHC-bearing cell is a MHC Class II-bearing cell.

20

191. The method of claim 190, wherein said MHC Class II-bearing cell is a B cell.

192. The method of claim 185, wherein said protein of interest is selected from the group consisting of HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ

25

ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG

30

protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein

precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); *S. aureus* enterotoxin A (SEQ ID NO:226); *E. coli* enterotoxin A (SEQ ID NO:227); *C. difficile* enterotoxin A (SEQ ID NO:228); *B. cereus* enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ 5 ID NO:230); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235).

10 193. The method of claim 185, wherein said OSPF-associated disorder is a viral infection due to a virus.

194. The method of claim 193, wherein said virus is selected from the group consisting of HIV, *e.g.*, HIV-1 and HIV-2, human herpes viruses, cytomegalovirus 15 ((esp Human), Rotavirus, Epstein-Barr virus, Varicella Zoster Virus, hepatitis viruses, such as hepatitis B virus, hepatitis A virus, hepatitis C virus and hepatitis E virus, paramyxoviruses: Respiratory Syncytial virus, parainfluenza virus, Ebola virus, measles virus, mumps virus, human papilloma viruses (for example HPV6, 11, 16, 18 and the like), flaviviruses (*e.g.* Yellow Fever Virus, Dengue Virus, Tick-borne 20 encephalitis virus, Japanese Encephalitis Virus) or influenza virus.

195. The method of claim 194, wherein said virus is Ebola virus.

196. The method of claim 192, wherein said protein of interest is Ebola virus 25 nucleoprotein (SEQ ID NO:210).

197. The method of claim 185, wherein said OSPF-associated disorder is a bacterial infection due to a bacteria.

30 198. The method of claim 197, wherein said bacteria is selected from the group consisting of *N. gonorrhoea* and *N. meningitidis*, *Streptococcus* spp, including *S. pneumoniae*, *S. pyogenes*, *S. agalactiae*, *S. mutans*; *Haemophilus* spp, including *H. influenzae* type B, non typeable *H. influenzae*, *H. ducreyi*; *Moraxella* spp, including

M catarrhalis, also known as Branhamella catarrhalis; Bordetella spp, including B. pertussis, B. parapertussis and B. bronchiseptica; Mycobacterium spp., including M. tuberculosis, M. bovis, M. leprae, M. avium, M. paratuberculosis, M. smegmatis; Legionella spp, including L. pneumophila; Escherichia spp, including enterotoxic E. coli, enterohemorragic E. coli, enteropathogenic E. coli; Vibrio spp, including V. cholera, Shigella spp, including S. sonnei, S. dysenteriae, S. flexnerii; Yersinia spp, including Y. enterocolitica, Y. pestis, Y. pseudotuberculosis, Campylobacter spp, including C. jejuni and C. coli; Salmonella spp, including S. typhi, S. paratyphi, S. choleraesuis, S. enteritidis; Listeria spp., including L. monocytogenes; Helicobacter spp, including H. pylori; Pseudomonas spp, including P. aeruginosa, Staphylococcus spp., including S. aureus, S. epidermidis; Enterococcus spp., including E. faecalis, E. faecium; Clostridium spp., including C. tetani, C. botulinum, C. difficile; Bacillus spp., including B. anthracis; Corynebacterium spp., including C. diphtheriae; Borrelia spp., including B. burgdorferi, B. garinii, B. afzelii, B. andersonii, B. hermsii; Ehrlichia spp., including E. equi and the agent of the Human Granulocytic Ehrlichiosis; Rickettsia spp, including R. rickettsii; Chlamydia spp., including C. trachomatis, C. neumoniae, C. psittaci; Leptira spp., including L. interrogans; Treponema spp., including T. pallidum, T. denticola, T. hyodysenteriae.

20 199. The method of claim 198, wherein said bacteria is B. anthracis.

200. The method of claim 192, wherein said protein of interest is anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209).

25 201. The method of claim 185, wherein said OSPF-associated disorder is a neoplastic disease.

202. The method of claim 201, wherein said neoplastic disease is selected from the group consisting of breast, colon, non-small cell lung, head and neck, colorectal, lung, prostate, ovary, renal, melanoma, gastrointestinal cancer and osteogenic sarcoma.

30 203. The method of claim 202, wherein said neoplastic disease is melanoma.

204. The method of claim 192, wherein said protein of interest is melanoma antigen p15 (SEQ ID NO:212).

205. The method of claim 185, wherein said OSPF-associated disorder is a state of  
5 toxicity due to a toxin.

206. The method of claim 205, wherein said toxin is selected from the group  
consisting of botulin, perfringens toxin, pertussis, mycotoxins, shigatoxins,  
staphylococcal enterotoxin B, tetanus, ricin, cholera, aflatoxins, diphtheria, T2,  
10 sequitoxin, saxitoxin, abrin, cyanoginosin, alphatoxin, tetrodotoxin, aconotoxin, snake  
venom, scorpion venom and spider venoms.

207. The method of claim 206, wherein said toxin is pertussis.

15 208. The method of claim 192, wherein said protein of interest is pertussis toxin  
subunit 3 (SEQ ID NO:230).

209. The method of claim 185, wherein said OSPF-associated disorder is a parasitic  
infection due to a parasite.

210. The method of claim 209, wherein said parasite is selected from the group  
consisting of Anaplasma, Babesia, Balantidium, Besnoitia, Chlamydia, Coccidia,  
Cryptospondium, Cytauxzoon, Eimeria Entamoeba, Eperythrozoon, Erlichia, Giardia,  
Haemobartonella, Hammondia, Isopora, Leishmania, Neorickettsia, Plasmodium,  
25 Pneumocystis, Rickettsia, Schistosoma, Sarcocystis, Theileria, Thrichinella,  
Toxoplasma, Trichomonas, Trypanosoma, Unicaria, Dipylidium, Echinococcuse,  
Taenia, Ancylostoma, Ascaris, Enterobius, Strongyloides, Strongylus, Toxocara,  
Toxascaris and Trichuris.

30 211. The method of claim 210, wherein said parasite is Plasmodium.

212. The method of claim 192, wherein said protein of interest is selected from the group consisting of circumsporozoite protein precursor (SEQ ID NO:223) and circumsporozoite protein II (SEQ ID NO:224).

5 213. The method of any one of claims 1, 14, 43 70, 156 or 185 further comprising an adjuvant.

10 214. The method of claim 213, wherein said adjuvant is selected from the group consisting of interleukin (IL)-2, IL-12, IL-15, Freund's adjuvant, corynebacterium parvum and alum.

15 215. An adjuvant for a vaccine comprising a pharmaceutically acceptable carrier and an overlapping synthetic peptide formulation (OSPF), wherein said OSPF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptide is a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, and wherein at least one single chain peptide overlaps with another single chain peptide by a length of Z, wherein Z is 1 to (Y-1), wherein said length of said single chain peptide is such that internalization of said single chain peptide by a MHC -bearing cell and presentation by a MHC molecule to a T cell is possible.

25 216. A adjuvant for a vaccine comprising a pharmaceutically acceptable carrier and an overlapping synthetic peptide formulation (OSPF), wherein said OSPF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein said length of said single chain peptides is such that internalization of said single chain peptide by a MHC -bearing cell and presentation by a MHC molecule to a T cell is possible.

30 217. A method of modulating an immune response comprising contacting a cell with an overlapping synthetic peptide formulation (OPSF) wherein said OPSF

comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein at least one single chain peptide overlaps with another single chain peptide by a length represented by Z, wherein Z is 1 to (Y-1), wherein said length of said single chain peptide is such that internalization of said single chain peptide by a MHC-bearing cell and presentation by a MHC molecule to a T cell is possible, such that said immune response is modulated.

10 218. A method of modulating an immune response comprising contacting a cell with an overlapping synthetic peptide formulation (OPSF) wherein said OPSF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein said length of said single chain peptides are such that internalization of said single chain peptide by a MHC-bearing cell and presentation by a MHC molecule to a T cell is possible, such that said immune response is modulated.

15 219. A method of treating an OSPF-associated disorder comprising contacting a cell with an overlapping synthetic peptide formulation (OPSF) wherein said OPSF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein at least one single chain peptide overlaps with another single chain peptide by a length represented by Z, wherein Z is 1 to (Y-1), wherein said length of said single chain peptide is such that internalization of said single chain peptide by a MHC-bearing cell and presentation by a MHC molecule to a T cell is possible, such that said OSPF-associated disorder is treated.

20 220. A method of treating an OSPF-associated disorder comprising contacting a cell with an overlapping synthetic peptide formulation (OPSF) wherein said OPSF comprises a combination of single chain peptides corresponding to an amino acid

sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein said length of said single chain peptides are such that internalization of said single chain peptide by a MHC-bearing cell and  
5 presentation by a MHC molecule to a T cell is possible, such that said OSPF-associated disorder is treated.

221. A method of preventing an OSPF-associated disorder comprising contacting a cell with an overlapping synthetic peptide formulation (OPSF) wherein said OPSF  
10 comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein at least one single chain peptide overlaps with another single chain peptide by a length represented by Z, wherein Z is 1 to (Y-1),  
15 wherein said length of said single chain peptide is such that internalization of said single chain peptide by a MHC-bearing cell and presentation by a MHC molecule to a T cell is possible, such that said OSPF-associated disorder is prevented.

222. A method of preventing an OSPF-associated disorder comprising contacting a cell with an overlapping synthetic peptide formulation (OPSF) wherein said OPSF  
20 comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein said length of said single chain peptides are such  
25 that internalization of said single chain peptide by a MHC-bearing cell and presentation by a MHC molecule to a T cell is possible, such that said OSPF-associated disorder is prevented.

223. The method of claims 217-222, wherein said Y is fifteen (15) amino acids.  
30  
224. The method of claims 217, 219 and 221, wherein said Z is five (5) amino acids.

225. The method of claims 217-222, wherein said immune response is a Th1-mediated immune response.

226. The method of claim 225, wherein said Th1-mediated immune response is a  
5 CTL-mediated immune response.

227. The method of claims 217-222, wherein said immune response is a Th2-mediated immune response.

10 228. The method of claim 227, wherein said Th2-mediated immune response is an antibody-associated immune response.

229. The method of claims 217-222, wherein said MHC-bearing cell is a MHC Class I-bearing cell.

15 230. The method of claim 229, wherein said MHC Class I-bearing cell is a CTL

231. The method of claims 217-222, wherein said MHC-bearing cell is a MHC Class II-bearing cell.

20 232. The method of claims 231, wherein said MHC Class II-bearing cell is a B cell.

233. The method of claims 217-222, wherein said protein of interest is selected from the group consisting of HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215);  
25 HIV-2 GAG protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222);  
30

circumsporozoite protein precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); *S. aureus* enterotoxin A (SEQ ID NO:226); *E. coli* enterotoxin A (SEQ ID NO:227); *C. difficile* enterotoxin A (SEQ ID NO:228); *B. cereus* enterotoxin A (SEQ ID NO:229);  
5 pertussis toxin subunit 3 (SEQ ID NO:230); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235).

10

234. The method of claims 219-222, wherein said OSPF-associated disorder is a viral infection due to a virus.

235. The method of claim 234, wherein said virus is selected from the group  
15 consisting of HIV, *e.g.*, HIV-1 and HIV-2, human herpes viruses, cytomegalovirus (esp. Human), Rotavirus, Epstein-Barr virus, Varicella Zoster Virus, hepatitis viruses, such as hepatitis B virus, hepatitis A virus, hepatitis C virus and hepatitis E virus, paramyxoviruses: Respiratory Syncytial virus, parainfluenza virus, Ebola virus, measles virus, mumps virus, human papilloma viruses (for example HPV6, 11, 16, 18  
20 and the like), flaviviruses (*e.g.* Yellow Fever Virus, Dengue Virus, Tick-borne encephalitis virus, Japanese Encephalitis Virus) or influenza virus.

236. The method of claim 235, wherein said virus is Ebola virus.

25 237. The method of claims 217-222, wherein said protein of interest is Ebola virus nucleoprotein (SEQ ID NO:210).

238. The method of claims 219-222, wherein said OSPF-associated disorder is a bacterial infection due to a bacteria.

30

239. The method of claim 238, wherein said bacteria is selected from the group consisting of *N. gonorrhoea* and *N. meningitidis*, *Streptococcus* spp, including *S. pneumoniae*, *S. pyogenes*, *S. agalactiae*, *S. mutans*; *Haemophilus* spp, including *H.*

influenzae type B, non typeable *H. influenzae*, *H. ducreyi*; *Moraxella* spp, including *M catarrhalis*, also known as *Branhamella catarrhalis*; *Bordetella* spp, including *B. pertussis*, *B. parapertussis* and *B. bronchiseptica*; *Mycobacterium* spp., including *M. tuberculosis*, *M. bovis*, *M. leprae*, *M. avium*, *M. paratuberculosis*, *M. smegmatis*;

5     *Legionella* spp, including *L. pneumophila*; *Escherichia* spp, including enterotoxic *E. coli*, enterohemorrhagic *E. coli*, enteropathogenic *E. coli*; *Vibrio* spp, including *V. cholera*, *Shigella* spp, including *S. sonnei*, *S. dysenteriae*, *S. flexnerii*; *Yersinia* spp, including *Y. enterocolitica*, *Y. pestis*, *Y. pseudotuberculosis*, *Campylobacter* spp, including *C. jejuni* and *C. coli*; *Salmonella* spp, including *S. typhi*, *S. paratyphi*, *S.*

10    *choleraesuis*, *S. enteritidis*; *Listeria* spp., including *L. monocytogenes*; *Helicobacter* spp, including *H. pylori*; *Pseudomonas* spp, including *P. aeruginosa*, *Staphylococcus* spp., including *S. aureus*, *S. epidermidis*; *Enterococcus* spp., including *E. faecalis*, *E. faecium*; *Clostridium* spp., including *C. tetani*, *C. botulinum*, *C. difficile*; *Bacillus* spp., including *B. anthracis*; *Corynebacterium* spp., including *C. diphtheriae*; *Borrelia* spp., including *B. burgdorferi*, *B. garinii*, *B. afzelii*, *B. andersonii*, *B. hermsii*; *Ehrlichia* spp., including *E. equi* and the agent of the Human Granulocytic Ehrlichiosis; *Rickettsia* spp, including *R. rickettsii*; *Chlamydia* spp., including *C. trachomatis*, *C. neumoniae*, *C. psittaci*; *Leptira* spp., including *L. interrogans*; *Treponema* spp., including *T. pallidum*, *T. denticola*, *T. hyoilecteriae*.

15

20

240. The method of claim 239, wherein said bacteria is *B. anthracis*.

241. The method of claims 217-222, wherein said protein of interest is anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209).

25

242. The method of claims 219-222, wherein said OSPF-associated disorder is a neoplastic disease.

30

243. The method of claim 242, wherein said neoplastic disease is selected from the group consisting of breast, colon, non-small cell lung, head and neck, colorectal, lung, prostate, ovary, renal, melanoma, gastrointestinal cancer and osteogenic sarcoma.

244. The method of claim 243, wherein said neoplastic disease is melanoma.

245. The method of claims 217-222, wherein said protein of interest is melanoma antigen p15 (SEQ ID NO:212).

5 246. The method of claims 219-222, wherein said OSPF-associated disorder is a state of toxicity due to a toxin.

247. The method of claim 246, wherein said toxin is selected from the group consisting of botulin, perfringens toxin, pertussis, mycotoxins, shigatoxins, 10 staphylococcal enterotoxin B, tetanus, ricin, cholera, aflatoxins, diphtheria, T2, seguitoxin, saxitoxin, abrin, cyanoginosin, alphatoxin, tetrodotoxin, aconotoxin, snake venom, scorpion venom and spider venoms.

248. The method of claim 246, wherein said toxin is pertussis.

15

249. The method of claims 217-222, wherein said protein of interest is pertussis toxin subunit 3 (SEQ ID NO:230).

250. The method of claims 219-222, wherein said OSPF-associated disorder is a 20 parasitic infection due to a parasite.

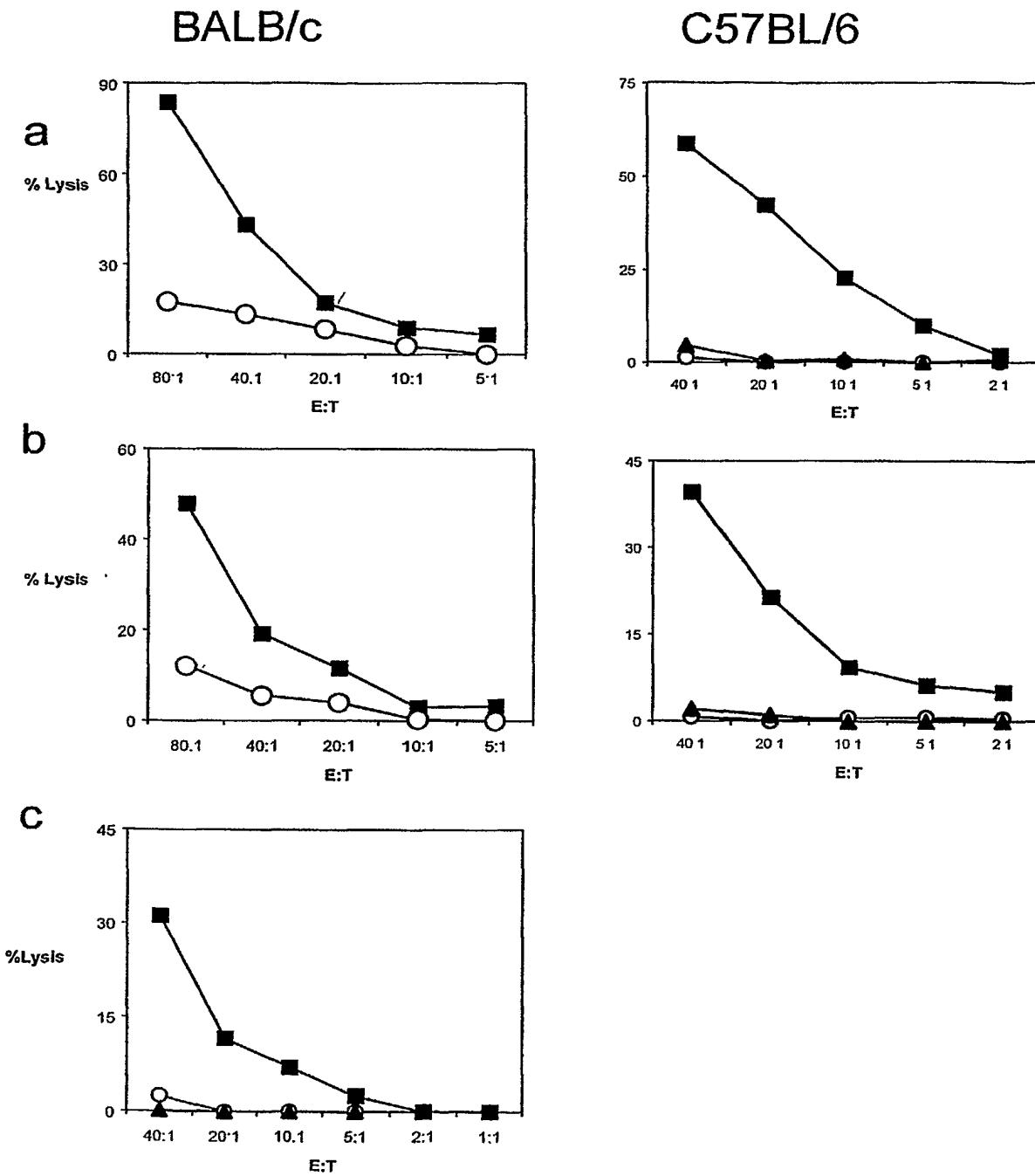
251. The method of claim 250, wherein said parasite is selected from the group consisting of Anaplasma, Babesia, Balantidium, Besnoitia, Chlamydia, Coccidia, Cryptosodium, Cytauxzoon, Eimeria Entamoeba, Eperythrozoon, Erlichia, Giardia, 25 Haemobartonella, Hammondia, Isopora, Leishmania, Neorickettsia, Plasmodium, Pneumocystis, Rickettsia, Schistosoma, Sarcocystis, Theileria, Thrichinella, Toxoplasma, Trichomonas, Trypanosoma, Unicaria, Dipylidium, Echinococcuse, Taenia, Ancylostoma, Ascaris, Enterobius, Strongyloides, Strongylus, Toxocara, Toxascaris and Trichuris.

30

252. The method of claim 251, wherein said parasite is Plasmodium.

253. The method of claims 217-222, wherein said protein of interest is circumsporozoite protein II (SEQ ID NO:224).

Fig. 1



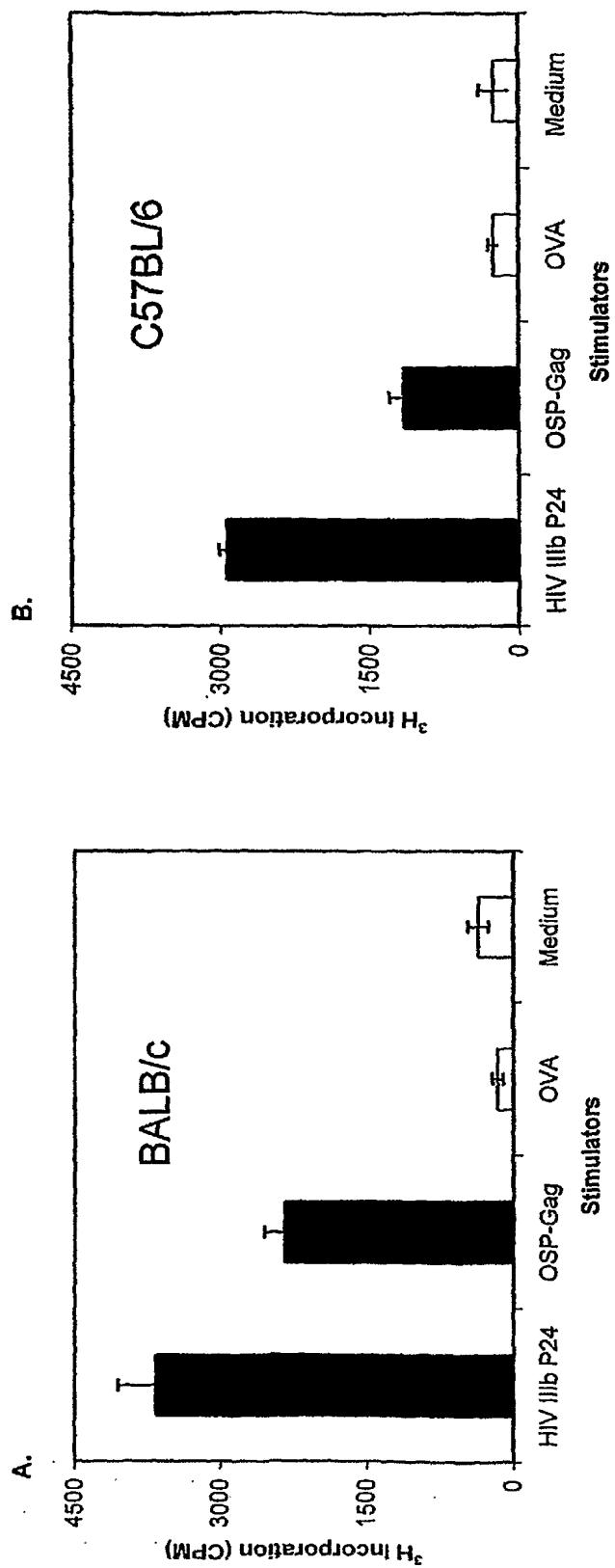
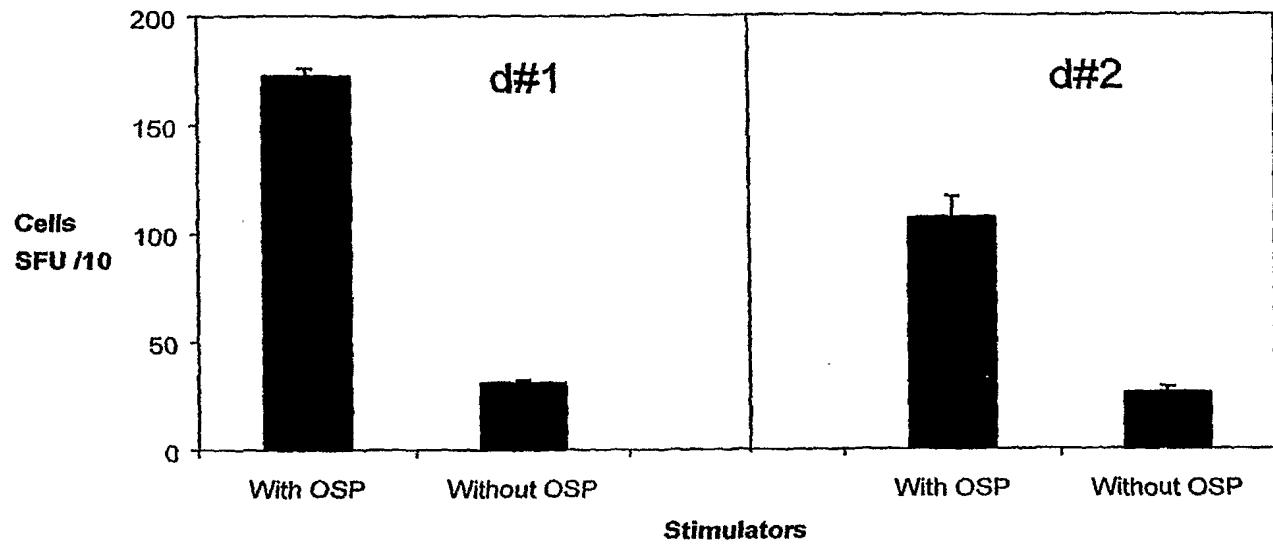
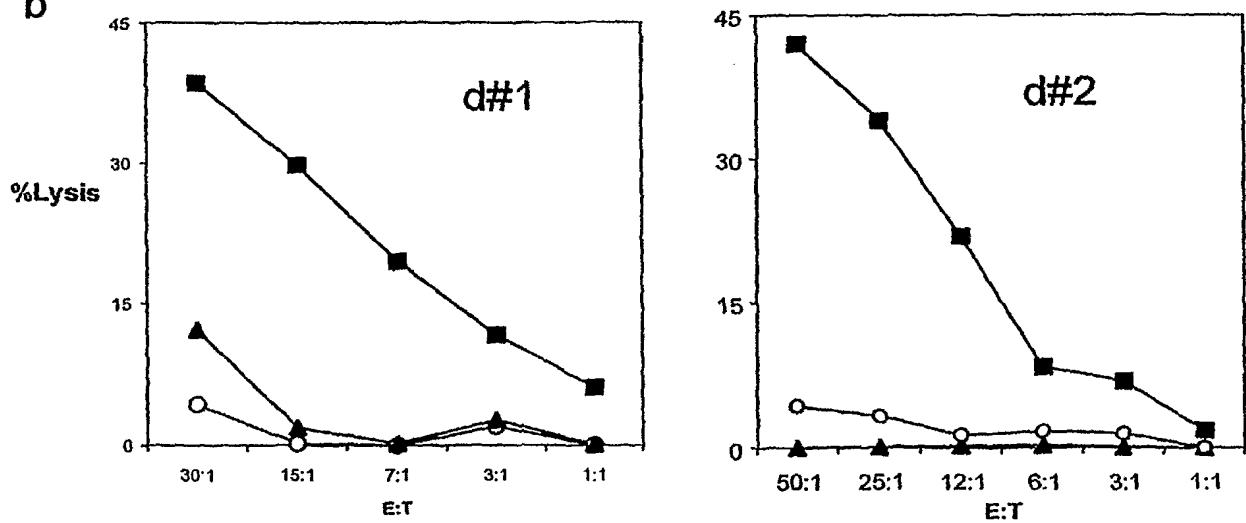


Fig. 2

SUBSTITUTE SHEET (RULE 26)

Fig. 3

**a****b**

## SEQUENCE LISTING

<110> Dana-Farber Cancer Institute, Inc., et al.

<120> COMPOSITIONS AND METHODS FOR MODULATING  
A CYTOTOXIC T LYMPHOCYTE IMMUNE RESPONSE

<130> DFN-043PC

<150> 60/392718

<151> 2002-06-27

<160> 340

<170> FastSEQ for Windows Version 4.0

<210> 1

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 1

Met Gly Ala Arg Ala Ser Val Leu Ser Gly Gly Glu Leu Asp Arg  
1 5 10 15

<210> 2

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 2

Ala Ser Val Leu Ser Gly Gly Glu Leu Asp Arg Trp Glu Lys Ile  
1 5 10 15

<210> 3

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 3

Ser Gly Gly Glu Leu Asp Arg Trp Glu Lys Ile Arg Leu Arg Pro  
1 5 10 15

<210> 4

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 4

Leu Asp Arg Trp Glu Lys Ile Arg Leu Arg Pro Gly Gly Lys Lys  
1 5 10 15

<210> 5

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 5

Glu Lys Ile Arg Leu Arg Pro Gly Gly Lys Lys Lys Tyr Lys Leu  
1 5 10 15

<210> 6

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 6

Leu Arg Pro Gly Gly Lys Lys Tyr Lys Leu Lys His Ile Val  
1 5 10 15

<210> 7

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 7

Gly Lys Lys Lys Tyr Lys Leu Lys His Ile Val Trp Ala Ser Arg  
1 5 10 15

<210> 8

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 8

Tyr Lys Leu Lys His Ile Val Trp Ala Ser Arg Glu Leu Glu Arg  
1 5 10 15

<210> 9

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 9

His Ile Val Trp Ala Ser Arg Glu Leu Glu Arg Phe Ala Val Asn  
1 5 10 15

<210> 10

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 10

Ala Ser Arg Glu Leu Glu Arg Phe Ala Val Asn Pro Gly Leu Leu  
1 5 10 15

<210> 11

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 11  
Leu Glu Arg Phe Ala Val Asn Pro Gly Leu Leu Glu Thr Ser Glu  
1 5 10 15

<210> 12  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 12  
Ala Val Asn Pro Gly Leu Leu Glu Thr Ser Glu Gly Cys Arg Gln  
1 5 10 15

<210> 13  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 13  
Gly Leu Leu Glu Thr Ser Glu Gly Cys Arg Gln Ile Leu Gly Gln  
1 5 10 15

<210> 14  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 14  
Thr Ser Glu Gly Cys Arg Gln Ile Leu Gly Gln Leu Gln Pro Ser  
1 5 10 15

<210> 15  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 15  
Cys Arg Gln Ile Leu Gly Gln Leu Gln Pro Ser Leu Gln Thr Gly  
1 5 10 15

<210> 16  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 16  
Leu Gly Gln Leu Gln Pro Ser Leu Gln Thr Gly Ser Glu Glu Leu  
1 5 10 15

<210> 17  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 17

Gln Pro Ser Leu Gln Thr Gly Ser Glu Glu Leu Arg Ser Leu Tyr  
1 5 10 15

<210> 18  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 18  
Gln Thr Gly Ser Glu Glu Leu Arg Ser Leu Tyr Asn Thr Val Ala  
1 5 10 15

<210> 19  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 19  
Glu Glu Leu Arg Ser Leu Tyr Asn Thr Val Ala Thr Leu Tyr Cys  
1 5 10 15

<210> 20  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 20  
Ser Leu Tyr Asn Thr Val Ala Thr Leu Tyr Cys Val His Gln Arg  
1 5 10 15

<210> 21  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 21  
Thr Val Ala Thr Leu Tyr Cys Val His Gln Arg Ile Glu Ile Lys  
1 5 10 15

<210> 22  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 22  
Leu Tyr Cys Val His Gln Arg Ile Glu Ile Lys Asp Thr Lys Glu  
1 5 10 15

<210> 23  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 23  
His Gln Arg Ile Glu Ile Lys Asp Thr Lys Glu Ala Leu Asp Lys

1

5

10

15

<210> 24  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 24  
Glu Ile Lys Asp Thr Leu Glu Ala Leu Asp Lys Ile Glu Glu Glu  
1 5 10 15

<210> 25  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 25  
Thr Lys Glu Ala Leu Asp Lys Ile Glu Glu Glu Gln Asn Lys Ser  
1 5 10 15

<210> 26  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 26  
Leu Asp Lys Ile Glu Glu Glu Gln Asn Lys Ser Lys Lys Lys Ala  
1 5 10 15

<210> 27  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 27  
Glu Glu Glu Gln Asn Lys Ser Lys Lys Lys Ala Gln Gln Ala Ala  
1 5 10 15

<210> 28  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 28  
Asn Lys Ser Lys Lys Ala Gln Gln Ala Ala Ala Asp Thr Gly  
1 5 10 15

<210> 29  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 29  
Lys Lys Ala Gln Gln Ala Ala Ala Asp Thr Gly His Ser Asn Gln

1

5

10

15

<210> 30  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 30  
Gln Ala Ala Ala Asp Thr Gly His Ser Asn Gln Val Ser Gln Asn  
1 5 10 15

<210> 31  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 31  
Asp Thr Gly His Ser Asn Gln Val Ser Gln Asn Tyr Pro Ile Val  
1 5 10 15

<210> 32  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 32  
Ser Asn Lys Val Ser Gln Asn Tyr Pro Ile Val Gln Asn Ile Gln  
1 5 10 15

<210> 33  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 33  
Ser Gln Asn Tyr Pro Ile Val Gln Asn Ile Gln Gly Gln Met Val  
1 5 10 15

<210> 34  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 34  
Pro Ile Val Gln Asn Ile Gln Gly Gln Met Val His Gln Ala Ile  
1 5 10 15

<210> 35  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 35  
Asn Ile Gln Gly Gln Met Val His Gln Ala Ile Ser Pro Arg Thr  
1 5 10 15

<210> 36  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 36  
Gln Met Val His Gln Ala Ile Ser Pro Arg Thr Leu Asn Ala Trp  
1 5 10 15

<210> 37  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 37  
Gln Ala Ile Ser Pro Arg Thr Leu Asn Ala Trp Val Lys Val Val  
1 5 10 15

<210> 38  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 38  
Pro Arg Thr Leu Asn Ala Trp Val Lys Val Val Glu Glu Lys Ala  
1 5 10 15

<210> 39  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 39  
Asn Ala Trp Val Lys Val Val Glu Glu Lys Ala Phe Ser Pro Glu  
1 5 10 15

<210> 40  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 40  
Lys Val Val Glu Glu Lys Ala Phe Ser Pro Glu Val Ile Pro Met  
1 5 10 15

<210> 41  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 41  
Glu Lys Ala Phe Ser Pro Glu Val Ile Pro Met Phe Ser Ala Leu  
1 5 10 15

<210> 42  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 42  
Ser Pro Glu Val Ile Pro Met Phe Ser Ala Leu Ser Glu Gly Ala  
1 5 10 15

<210> 43  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 43  
Ile Pro Met Phe Ser Ala Leu Ser Glu Gly Ala Thr Pro Gln Asp  
1 5 10 15

<210> 44  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 44  
Ser Ala Leu Ser Glu Gly Ala Thr Pro Gln Asp Leu Asn Thr Met  
1 5 10 15

<210> 45  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 45  
Glu Gly Ala Thr Pro Gln Asp Leu Asn Thr Met Leu Asn Thr Val  
1 5 10 15

<210> 46  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 46  
Pro Gln Asp Leu Asn Thr Met Leu Asn Thr Val Gly Gly His Gln  
1 5 10 15

<210> 47  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 47  
Asn Thr Met Leu Asn Thr Val Gly Gly His Gln Ala Ala Met Gln  
1 5 10 15

<210> 48  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 48  
Asn Thr Val Gly Gly His Gln Ala Ala Met Gln Met Leu Lys Glu  
1 5 10 15

<210> 49  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 49  
Gly His Gln Ala Ala Met Gln Met Leu Lys Glu Thr Ile Asn Glu  
1 5 | 10 15

<210> 50  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 50  
Ala Met Gln Met Leu Lys Glu Thr Ile Asn Glu Glu Ala Ala Glu  
1 5 10 15

<210> 51  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 51  
Leu Lys Glu Thr Ile Asn Glu Glu Ala Ala Glu Trp Asp Arg Val  
1 5 10 15

<210> 52  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 52  
Ile Asn Glu Glu Ala Ala Glu Trp Asp Arg Val His Pro Val His  
1 5 10 15

<210> 53  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 53  
Ala Ala Glu Trp Asp Arg Val His Pro Val His Ala Gly Pro Ile  
1 5 10 15

<210> 54  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 54  
Asp Arg Val His Pro Val His Ala Gly Pro Ile Ala Pro Gly Gln  
1 5 10 15

<210> 55  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 55  
Pro Val His Ala Gly Pro Ile Ala Pro Gly Gln Met Arg Glu Pro  
1 5 10 15

<210> 56  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 56  
Gly Pro Ile Ala Pro Gly Gln Met Arg Glu Pro Arg Gly Ser Asp  
1 5 10 15

<210> 57  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 57  
Pro Gly Gln Met Arg Glu Pro Arg Gly Ser Asp Ile Ala Gly Thr  
1 5 10 15

<210> 58  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 58  
Arg Glu Pro Arg Gly Ser Asp Ile Ala Gly Thr Thr Ser Thr Leu  
1 5 10 15

<210> 59  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 59  
Gly Ser Asp Ile Ala Gly Thr Thr Ser Thr Leu Gln Glu Gln Ile  
1 5 10 15

<210> 60  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 60  
Ala Gly Thr Thr Ser Thr Leu Gln Glu Gln Ile Gly Trp Met Thr  
1 5 10 15

<210> 61  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 61  
Ser Thr Leu Gln Glu Gln Ile Gly Trp Met Thr Asn Asn Pro Pro  
1 5 10 15

<210> 62  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 62  
Glu Gln Ile Gly Trp Met Thr Asn Asn Pro Pro Ile Pro Val Gly  
1 5 10 15

<210> 63  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 63  
Trp Met Thr Asn Asn Pro Pro Ile Pro Val Gly Glu Ile Tyr Lys  
1 5 10 15

<210> 64  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 64  
Asn Pro Pro Ile Pro Val Gly Glu Ile Tyr Lys Arg Trp Ile Ile  
1 5 10 15

<210> 65  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 65  
Pro Val Gly Glu Ile Tyr Lys Arg Trp Ile Ile Leu Gly Leu Asn  
1 5 10 15

<210> 66

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 66

Ile Tyr Lys Arg Trp Ile Ile Leu Gly Leu Asn Lys Ile Val Arg  
1 5 10 15

<210> 67

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 67

Trp Ile Ile Leu Gly Leu Asn Lys Ile Val Arg Met Tyr Ser Pro  
1 5 10 15

<210> 68

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 68

Gly Leu Asn Lys Ile Val Arg Met Tyr Ser Pro Thr Ser Ile Leu  
1 5 10 15

<210> 69

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 69

Ile Val Arg Met Tyr Ser Pro Thr Ser Ile Leu Asp Ile Arg Gln  
1 5 10 15

<210> 70

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 70

Tyr Ser Pro Thr Ser Ile Leu Asp Ile Arg Gln Gly Pro Lys Glu  
1 5 10 15

<210> 71

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 71

Ser Ile Leu Asp Ile Arg Gln Gly Pro Lys Glu Pro Phe Arg Asp  
1 5 10 15

<210> 72

<211> 15

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 72

Ile	Arg	Gln	Gly	Pro	Lys	Glu	Pro	Phe	Arg	Asp	Tyr	Val	Asp	Arg
1				5					10				15	

&lt;210&gt; 73

&lt;211&gt; 15

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 73

Pro	Lys	Glu	Pro	Phe	Arg	Asp	Tyr	Val	Asp	Arg	Phe	Tyr	Lys	Thr
1				5					10				15	

&lt;210&gt; 74

&lt;211&gt; 15

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 74

Phe	Arg	Asp	Tyr	Val	Asp	Arg	Phe	Tyr	Lys	Thr	Leu	Arg	Ala	Glu
1				5					10				15	

&lt;210&gt; 75

&lt;211&gt; 15

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 75

Val	Asp	Arg	Phe	Tyr	Lys	Thr	Leu	Arg	Ala	Glu	Gln	Ala	Ser	Gln
1				5					10				15	

&lt;210&gt; 76

&lt;211&gt; 15

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 76

Tyr	Lys	Thr	Leu	Arg	Ala	Glu	Gln	Ala	Ser	Gln	Glu	Val	Lys	Asn
1				5					10				15	

&lt;210&gt; 77

&lt;211&gt; 15

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 77

Arg	Ala	Glu	Gln	Ala	Ser	Gln	Glu	Val	Lys	Asn	Trp	Met	Thr	Glu
1					5				10				15	

&lt;210&gt; 78

&lt;211&gt; 15

&lt;212&gt; PRT

<213> Human Immunodeficiency Virus

<400> 78  
Ala Ser Gln Glu Val Lys Asn Trp Met Thr Glu Thr Leu Leu Val  
1 5 10 15

<210> 79

<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 79  
Val Lys Asn Trp Met Thr Glu Thr Leu Leu Val Gln Asn Ala Asn  
1 5 . 10 15

<210> 80  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 80  
Met Thr Glu Thr Leu Leu Val Gln Asn Ala Asn Pro Asp Cys Lys  
1 5 10 15

<210> 81  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 81  
Leu Leu Val Gln Asn Ala Asn Pro Asp Cys Lys Thr Ile Leu Lys  
1 5 10 15

<210> 82  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 82  
Asn Ala Asn Pro Asp Cys Lys Thr Ile Leu Lys Ala Leu Gly Pro  
1 5 10 15

<210> 83  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 83  
Asp Cys Lys Thr Ile Leu Lys Ala Leu Gly Pro Ala Ala Thr Leu  
1 5 10 15

<210> 84  
<211> 15  
<212> PRT

<213> Human Immunodeficiency Virus

<400> 84

Ile Leu Lys Ala Leu Gly Pro Ala Ala Thr Leu Glu Glu Met Met  
1 5 10 15

<210> 85

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 85

Leu Gly Pro Ala Ala Thr Leu Glu Glu Met Met Thr Ala Cys Gln  
1 5 10 15

<210> 86

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 86

Ala Thr Leu Glu Glu Met Met Thr Ala Cys Gln Gly Val Gly Gly  
1 5 10 15

<210> 87

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 87

Glu Met Met Thr Ala Cys Gln Gly Val Gly Gly Pro Gly His Lys  
1 5 10 15

<210> 88

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 88

Ala Cys Gln Gly Val Gly Gly Pro Gly His Lys Ala Arg Val Leu  
1 5 10 15

<210> 89

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 89

Val Gly Gly Pro Gly His Lys Ala Arg Val Leu Ala Glu Ala Met  
1 5 10 15

<210> 90

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 90  
Gly His Lys Ala Arg Val Leu Ala Glu Ala Met Ser Gln Val Thr  
1 5 10 15

<210> 91  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 91  
Arg Val Leu Ala Glu Ala Met Ser Gln Val Thr Asn Ser Ala Thr  
1 5 10 15

<210> 92  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 92  
Glu Ala Met Ser Gln Val Thr Asn Ser Ala Thr Ile Met Met Gln  
1 5 10 15

<210> 93  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 93  
Gln Val Thr Asn Ser Ala Thr Ile Met Met Gln Arg Gly Asn Phe  
1 5 10 15

<210> 94  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 94  
Ser Ala Thr Ile Met Met Gln Arg Gly Asn Phe Arg Asn Gln Arg  
1 5 10 15

<210> 95  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 95  
Met Met Gln Arg Gly Asn Phe Arg Asn Gln Arg Lys Ile Val Lys  
1 5 10 15

<210> 96  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 96

Gly Asn Phe Arg Asn Gln Arg Lys Ile Val Lys Cys Phe Asn Cys  
1 5 10 15

<210> 97

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 97

Asn Gln Arg Lys Ile Val Lys Cys Phe Asn Cys Gly Lys Glu Gly  
1 5 10 15

<210> 98

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 98

Ile Val Lys Cys Phe Asn Cys Gly Lys Glu Gly His Thr Ala Arg  
1 5 10 15

<210> 99

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 99

Phe Asn Cys Gly Lys Glu Gly His Thr Ala Arg Asn Cys Arg Ala  
1 5 10 15

<210> 100

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 100

Lys Glu Gly His Thr Ala Arg Asn Cys Arg Ala Pro Arg Lys Lys  
1 5 10 15

<210> 101

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 101

Thr Ala Arg Asn Cys Arg Ala Pro Arg Lys Lys Gly Cys Trp Lys  
1 5 10 15

<210> 102

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 102  
Cys Arg Ala Pro Arg Lys Lys Gly Cys Trp Lys Cys Gly Lys Glu  
1 5 10 15

<210> 103  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 103  
Arg Lys Lys Gly Cys Trp Lys Cys Gly Lys Glu Gly His Gln Met  
1 5 10 15

<210> 104  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 104  
Cys Trp Lys Cys Gly Lys Glu Gly His Gln Met Lys Asp Cys Thr  
1 5 10 15

<210> 105  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 105  
Gly Lys Glu Gly His Gln Met Lys Asp Cys Thr Glu Arg Gln Ala  
1 5 10 15

<210> 106  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 106  
His Gln Met Lys Asp Cys Thr Glu Arg Gln Ala Asn Phe Leu Gly  
1 5 10 15

<210> 107  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 107  
Asp Cys Thr Glu Arg Gln Ala Asn Phe Leu Gly Lys Ile Trp Pro  
1 5 10 15

<210> 108  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 108  
Arg Gln Ala Asn Phe Leu Gly Lys Ile Trp Pro Ser Tyr Lys Gly  
1 5 10 15

<210> 109  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 109  
Phe Leu Gly Lys Ile Trp Pro Ser Tyr Lys Gly Arg Pro Gly Asn  
1 5 10 15

<210> 110  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 110  
Ile Trp Pro Ser Tyr Lys Gly Arg Pro Gly Asn Phe Leu Gln Ser  
1 5 10 15

<210> 111  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 111  
Tyr Lys Gly Arg Pro Gly Asn Phe Leu Gln Ser Arg Pro Glu Pro  
1 5 10 15

<210> 112  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 112  
Pro Gly Asn Phe Leu Gln Ser Arg Pro Glu Pro Thr Ala Pro Pro  
1 5 10 15

<210> 113  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 113  
Leu Gln Ser Arg Pro Glu Pro Thr Ala Pro Pro Glu Glu Ser Phe  
1 5 10 15

<210> 114  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 114

Pro Glu Pro Thr Ala Pro Pro Glu Glu Ser Phe Arg Ser Gly Val  
1 5 10 15

<210> 115  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 115  
Ala Pro Pro Glu Glu Ser Phe Arg Ser Gly Val Glu Thr Thr Thr  
1 5 10 15

<210> 116  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 116  
Glu Ser Phe Arg Ser Gly Val Glu Thr Thr Thr Pro Pro Gln Lys  
1 5 10 15

<210> 117  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 117  
Ser Gly Val Glu Thr Thr Pro Pro Gln Lys Gln Glu Pro Ile  
1 5 10 15

<210> 118  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 118  
Thr Thr Thr Pro Pro Gln Lys Gln Glu Pro Ile Asp Lys Glu Leu  
1 5 10 15

<210> 119  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 119  
Pro Gln Lys Gln Glu Pro Ile Asp Lys Glu Leu Tyr Pro Leu Thr  
1 5 10 15

<210> 120  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 120  
Glu Pro Ile Asp Lys Glu Leu Tyr Pro Leu Thr Ser Leu Arg Ser

1

5

10

15

<210> 121  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 121  
Lys Glu Leu Tyr Pro Leu Thr Ser Leu Arg Ser Leu Phe Gly Asn  
1 5 10 15

<210> 122  
<211> 16  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 122  
Pro Leu Thr Ser Leu Arg Ser Leu Phe Gly Asn Asp Pro Ser Ser Gln  
1 5 10 15

<210> 123  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 123  
Met Gly Cys Leu Gly Asn Gln Leu Leu Ile Ala Ile Leu Leu Ser  
1 5 10 15  
Val Tyr Gly Ile  
20

<210> 124  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 124  
Ala Ile Leu Leu Ser Val Tyr Gly Ile Tyr Cys Thr Leu Tyr Val  
1 5 10 15  
Thr Val Phe Tyr  
20

<210> 125  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 125  
Tyr Cys Thr Leu Tyr Val Thr Val Phe Tyr Gly Val Pro Ala Trp Arg  
1 5 10 15  
Asn Ala Thr Ile  
20

<210> 126

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 126

Gly Val Pro Ala Trp Arg Asn Ala Thr Ile Pro Leu Phe Cys Ala Thr  
1 5 10 15

Lys Asn Arg Asp  
20

<210> 127

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 127

Pro Leu Phe Cys Ala Thr Lys Asn Arg Asp Thr Trp Gly Thr Thr Gln  
1 5 10 15

Cys Leu Pro Asp  
20

<210> 128

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 128

Thr Trp Gly Thr Thr Gln Cys Leu Pro Asp Asn Gly Asp Tyr Ser Glu  
1 5 10 15

Val Ala Leu Asn  
20

<210> 129

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 129

Asn Gly Asp Tyr Ser Glu Val Ala Leu Asn Val Thr Glu Ser Phe Asp  
1 5 10 15

Ala Trp Asn Asn  
20

<210> 130

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 130

Val Thr Glu Ser Phe Asp Ala Trp Asn Asn Thr Val Thr Glu Gln Ala  
1 5 10 15

Ile Glu Asp Val  
20

<210> 131

<211> 20

&lt;212&gt; PRT

&lt;213&gt; Simian Immunodeficiency Virus

&lt;400&gt; 131

Thr	Val	Thr	Glu	Gln	Ala	Ile	Glu	Asp	Val	Trp	Gln	Leu	Phe	Glu	Thr
1															15
Ser	Ile	Lys	Pro												
															20

&lt;210&gt; 132

&lt;211&gt; 20

&lt;212&gt; PRT

&lt;213&gt; Simian Immunodeficiency Virus

&lt;400&gt; 132

Trp	Gln	Leu	Phe	Glu	Thr	Ser	Ile	Lys	Pro	Cys	Val	Lys	Leu	Ser	Pro
1															15
Leu	Cys	Ile	Thr												
															20

&lt;210&gt; 133

&lt;211&gt; 20

&lt;212&gt; PRT

&lt;213&gt; Simian Immunodeficiency Virus

&lt;400&gt; 133

Cys	Val	Lys	Leu	Ser	Pro	Leu	Cys	Ile	Thr	Met	Arg	Cys	Asn	Lys	Ser
1															15
Glu	Thr	Asp	Arg												
															20

&lt;210&gt; 134

&lt;211&gt; 20

&lt;212&gt; PRT

&lt;213&gt; Simian Immunodeficiency Virus

&lt;400&gt; 134

Met	Arg	Cys	Asn	Lys	Ser	Glu	Thr	Asp	Arg	Trp	Gly	Leu	Thr	Lys	Ser
1															15
Ile	Thr	Thr	Thr												
															20

&lt;210&gt; 135

&lt;211&gt; 20

&lt;212&gt; PRT

&lt;213&gt; Simian Immunodeficiency Virus

&lt;400&gt; 135

Trp	Gly	Leu	Thr	Lys	Ser	Ile	Thr	Thr	Ala	Ser	Thr	Thr	Ser	Thr	
1															15
Thr	Ala	Ser	Ala												
															20

&lt;210&gt; 136

&lt;211&gt; 20

&lt;212&gt; PRT

<213> Simian Immunodeficiency Virus

<400> 136  
Ala Ser Thr Thr Ser Thr Ala Ser Ala Lys Val Asp Met Val Asn  
1 5 10 15  
Glu Thr Ser Ser  
20

<210> 137  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 137  
Lys Val Asp Met Val Asn Glu Thr Ser Ser Cys Ile Ala Gln Asp Asn  
1 5 10 15  
Cys Thr Gly Leu  
20

<210> 138  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 138  
Cys Ile Ala Gln Asp Asn Cys Thr Gly Leu Glu Gln Glu Gln Met Ile  
1 5 10 15  
Ser Cys Lys Phe  
20

<210> 139  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 139  
Glu Gln Glu Gln Met Ile Ser Cys Lys Phe Asn Met Thr Gly Leu Lys  
1 5 10 15  
Arg Asp Lys Lys  
20

<210> 140  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 140  
Asn Met Thr Gly Leu Lys Arg Asp Lys Lys Lys Glu Tyr Asn Glu Thr  
1 5 10 15  
Trp Tyr Ser Ala  
20

<210> 141  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 141  
Lys Glu Tyr Asn Glu Thr Trp Tyr Ser Ala Asp Leu Val Cys Glu Gln  
1 5 10 15  
Gly Asn Asn Thr  
20

<210> 142  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 142  
Asp Leu Val Cys Glu Gln Gly Asn Asn' Thr Gly Asn Glu Ser Arg Cys  
1 5 10 15  
Tyr Met Asn His  
20

<210> 143  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 143  
Gly Asn Glu Ser Arg Cys Tyr Met Asn His Cys Asn Thr Ser Val Ile  
1 5 10 15  
Gln Glu Ser Cys  
20

<210> 144  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 144  
Cys Asn Thr Ser Val Ile Gln Glu Ser Cys Asp Lys His Tyr Trp Asp  
1 5 10 15  
Ala Ile Arg Phe  
20

<210> 145  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 145  
Asp Lys His Tyr Trp Asp Ala Ile Arg Phe Arg Tyr Cys Ala Pro Pro  
1 5 10 15  
Gly Tyr Ala Leu  
20

<210> 146  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 146  
Arg Tyr Cys Ala Pro Pro Gly Tyr Ala Leu Leu Arg Cys Asn Asp Thr  
1 5 10 15  
Asn Tyr Ser Gly  
20

<210> 147  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 147  
Leu Arg Cys Asn Asp Thr Asn Tyr Ser Gly Phe Met Pro Lys Cys Ser  
1 5 10 15  
Lys Val Val Val  
20

<210> 148  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 148  
Phe Met Pro Lys Cys Ser Lys Val Val Val Ser Ser Cys Thr Arg Met  
1 5 10 15  
Met Glu Thr Gln  
20

<210> 149  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 149  
Ser Ser Cys Thr Arg Met Met Glu Thr Gln Thr Ser Thr Trp Phe Gly  
1 5 10 15  
Phe Asn Gly Thr  
20

<210> 150  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 150  
Thr Ser Thr Trp Phe Gly Phe Asn Gly Thr Arg Ala Glu Asn Arg Thr  
1 5 10 15  
Tyr Ile Tyr Trp  
20

<210> 151  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 151

Arg Ala Glu Asn Arg Thr Tyr Ile Tyr Trp His Gly Arg Asp Asn Arg  
1 5 10 15  
Thr Ile Ile Ser  
20

<210> 152  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 152  
His Gly Arg Asp Asn Arg Thr Ile Ile Ser Leu Asn Lys Tyr Tyr Asn  
1 5 10 15  
Leu Thr Met Lys  
20

<210> 153  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 153  
Leu Asn Lys Tyr Tyr Asn Leu Thr Met Lys Cys Arg Arg Pro Gly Asn  
1 5 10 15  
Lys Thr Val Leu  
20

<210> 154  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 154  
Cys Arg Arg Pro Gly Asn Lys Thr Val Leu Pro Val Thr Ile Met Ser  
1 5 10 15  
Gly Leu Val Phe  
20

<210> 155  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 155  
Pro Val Thr Ile Met Ser Gly Leu Val Phe His Ser Gln Pro Ile Asn  
1 5 10 15  
Asp Arg Pro Lys  
20

<210> 156  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 156  
His Ser Gln Pro Ile Asn Asp Arg Pro Lys Gln Ala Trp Cys Trp Phe

1 5 10 15  
Gly Gly Lys Trp  
20  
  
<210> 157  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus  
  
<400> 157  
Gln Ala Trp Cys Trp Phe Gly Gly Lys Trp Lys Asp Ala Ile Lys Glu  
1 5 10 15  
Val Lys Gln Thr  
20

<210> 158  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus  
  
<400> 158  
Lys Asp Ala Ile Lys Glu Val Lys Gln Thr Ile Val Lys His Pro Arg  
1 5 10 15  
Tyr Thr Gly Thr  
20

<210> 159  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus  
  
<400> 159  
Ile Val Lys His Pro Arg Tyr Thr Gly Thr Asn Asn Thr Asp Lys Ile  
1 5 10 15  
Asn Leu Thr Ala  
20

<210> 160  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus  
  
<400> 160  
Asn Asn Thr Asp Lys Ile Asn Leu Thr Ala Pro Gly Gly Gly Asp Pro  
1 5 10 15  
Glu Val Thr Phe  
20

<210> 161  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus  
  
<400> 161

Pro Gly Gly Gly Asp Pro Glu Val Thr Phe Met Trp Thr Asn Cys Arg  
1 5 10 15  
Gly Glu Phe Leu  
20

<210> 162  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 162  
Met Trp Thr Asn Cys Arg Gly Glu Phe Leu Tyr Cys Lys Met Asn Trp  
1 5 10 15  
Phe Leu Asn Trp  
20

<210> 163  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 163  
Tyr Cys Lys Met Asn Trp Phe Leu Asn Trp Val Glu Asp Arg Asn Thr  
1 5 10 15  
Ala Asn Gln Lys  
20

<210> 164  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 164  
Val Glu Asp Arg Asn Thr Ala Asn Gln Lys Pro Lys Glu Gln His Lys  
1 5 10 15  
Arg Asn Tyr Val  
20

<210> 165  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 165  
Pro Lys Glu Gln His Lys Arg Asn Tyr Val Pro Cys His Ile Arg Gln  
1 5 10 15  
Ile Ile Asn Thr  
20

<210> 166  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 166  
Pro Cys His Ile Arg Gln Ile Ile Asn Thr Trp His Lys Val Gly Lys

1	5	10	15
Asn Val Tyr Leu			
20			

<210> 167  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 167  
Trp His Lys Val Gly Lys Asn Val Tyr Leu Pro Pro Arg Glu Gly Asp  
1 5 10 15  
Leu Thr Cys Asn  
20

<210> 168  
<211> 20  
<212> PRT

<213> Simian Immunodeficiency Virus

<400> 168  
Pro Pro Arg Glu Gly Asp Leu Thr Cys Asn Ser Thr Val Thr Ser Leu  
1 5 10 15  
Ile Ala Asn Ile  
20

<210> 169  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 169  
Ser Thr Val Thr Ser Leu Ile Ala Asn Ile Asp Trp Ile Asp Gly Asn  
1 5 10 15  
Gln Thr Asn Ile  
20

<210> 170  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 170  
Asp Trp Ile Asp Gly Asn Gln Thr Asn Ile Thr Met Ser Ala Glu Val  
1 5 10 15  
Ala Glu Leu Tyr  
20

<210> 171  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 171  
Thr Met Ser Ala Glu Val Ala Glu Leu Tyr Arg Leu Glu Leu Gly Asp

1 5 10 15  
Tyr Lys Leu Val  
20

<210> 172  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 172  
Arg Leu Glu Leu Gly Asp Tyr Lys Leu Val Glu Ile Thr Pro Ile Gly  
1 5 10 15  
Leu Ala Pro Thr  
20

<210> 173  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 173  
Glu Ile Thr Pro Ile Gly Leu Ala Pro Thr Asp Val Lys Arg Tyr Thr  
1 5 10 15  
Thr Gly Gly Thr  
20

<210> 174  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 174  
Asp Val Lys Arg Tyr Thr Gly Gly Thr Ser Arg Asn Lys Arg Gly  
1 5 10 15  
Val Phe Val Leu  
20

<210> 175  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 175  
Ser Arg Asn Lys Arg Gly Val Phe Val Leu Gly Phe Leu Gly Phe Leu  
1 5 10 15  
Ala Thr Ala Gly  
20

<210> 176  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 176  
Gly Phe Leu Gly Phe Leu Ala Thr Ala Gly Ser Ala Met Gly Ala Ala  
1 5 10 15

Ser Leu Thr Leu  
20

<210> 177  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 177  
Ser Ala Met Gly Ala Ala Ser Leu Thr Leu Thr Ala Gln Ser Arg Thr  
1 5 10 15  
Leu Leu Ala Gly  
20

<210> 178  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 178  
Thr Ala Gln Ser Arg Thr Leu Leu Ala Gly Ile Val Gln Gln Gln Gln  
1 5 10 15  
Gln Leu Leu Asp  
20

<210> 179  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 179  
Ile Val Gln Gln Gln Gln Leu Leu Asp Val Val Lys Arg Gln Gln  
1 5 10 15  
Glu Leu Leu Arg  
20

<210> 180  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 180  
Val Val Lys Arg Gln Gln Glu Leu Leu Arg Leu Thr Val Trp Gly Thr  
1 5 10 15  
Lys Asn Leu Gln  
20

<210> 181  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 181  
Leu Thr Val Trp Gly Thr Lys Asn Leu Gln Thr Arg Val Thr Ala Ile  
1 5 - 10 15  
Glu Lys Tyr Leu

<210> 182  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 182  
Thr Arg Val Thr Ala Ile Glu Lys Tyr Leu Lys Asp Gln Ala Gln Leu  
1 5 10 15  
Asn Ala Trp Gly  
20

<210> 183  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 183  
Lys Asp Gln Ala Gln Leu Asn Ala Trp Gly Cys Ala Phe Arg Gln Val  
1 5 10 15  
Cys His Thr Thr  
20

<210> 184  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 184  
Cys Ala Phe Arg Gln Val Cys His Thr Thr Val Pro Trp Pro Asn Ala  
1 5 10 15  
Ser Leu Thr Pro  
20

<210> 185  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 185  
Val Pro Trp Pro Asn Ala Ser Leu Thr Pro Lys Trp Asn Asn Glu Thr  
1 5 10 15  
Trp Gln Glu Trp  
20

<210> 186  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 186  
Lys Trp Asn Asn Glu Thr Trp Gln Glu Trp Glu Arg Lys Val Asp Phe  
1 5 10 15  
Leu Glu Glu Asn  
20

<210> 187  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 187  
Glu Arg Lys Val Asp Phe Leu Glu Glu Asn Ile Thr Ala Leu Leu Glu  
1 5 10 15  
Glu Ala Gln Ile  
20

<210> 188  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 188  
Ile Thr Ala Leu Leu Glu Glu Ala Gln Ile Gln Gln Glu Lys Asn Met  
1 5 10 15  
Tyr Glu Leu Gln  
20

<210> 189  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 189  
Gln Gln Glu Lys Asn Met Tyr Glu Leu Gln Lys Leu Asn Ser Trp Asp  
1 5 10 15  
Val Phe Gly Asn  
20

<210> 190  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 190  
Lys Leu Asn Ser Trp Asp Val Phe Gly Asn Trp Phe Asp Leu Ala Ser  
1 5 10 15  
Trp Ile Lys Tyr  
20

<210> 191  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 191  
Trp Phe Asp Leu Ala Ser Trp Ile Lys Tyr Ile Gln Tyr Gly Val Tyr  
1 5 10 15  
Ile Val Val Gly  
20

<210> 192  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 192  
Ile Gln Tyr Gly Val Tyr Ile Val Val Gly Val Ile Leu Leu Arg Ile  
1 5 10 15  
Val Ile Tyr Ile  
20

<210> 193  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 193  
Val Ile Leu Leu Arg Ile Val Ile Tyr Ile Val Gln Met Leu Ala Lys  
1 5 10 15  
Leu Arg Gln Gly  
20

<210> 194  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 194  
Val Gln Met Leu Ala Lys Leu Arg Gln Gly Tyr Arg Pro Val Phe Ser  
1 5 10 15  
Ser Pro Pro Ser  
20

<210> 195  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 195  
Tyr Arg Pro Val Phe Ser Ser Pro Pro Ser Tyr Phe Gln Gln Thr His  
1 5 10 15  
Ile Gln Gln Asp  
20

<210> 196  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 196  
Tyr Phe Gln Gln Thr His Ile Gln Gln Asp Pro Ala Leu Pro Thr Arg  
1 5 10 15  
Glu Gly Lys Glu  
20

<210> 197

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 197

Pro Ala Leu Pro Thr Arg Glu Gly Lys Glu Arg Asp Gly Gly Glu Gly  
1 5 10 15  
Gly Gly Asn Ser  
20

<210> 198

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 198

Arg Asp Gly Gly Glu Gly Gly Asn Ser Ser Trp Pro Trp Gln Ile  
1 5 10 15  
Glu Tyr Ile His  
20

<210> 199

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 199

Ser Trp Pro Trp Gln Ile Glu Tyr Ile His Phe Leu Ile Arg Gln Leu  
1 5 10 15  
Ile Arg Leu Leu  
20

<210> 200

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 200

Phe Leu Ile Arg Gln Leu Ile Arg Leu Leu Thr Trp Leu Phe Ser Asn  
1 5 10 15  
Cys Arg Thr Leu  
20

<210> 201

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 201

Thr Trp Leu Phe Ser Asn Cys Arg Thr Leu Leu Ser Arg Val Tyr Gln  
1 5 10 15  
Ile Leu Gln Pro  
20

<210> 202

<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 202  
Leu Ser Arg Val Tyr Gln Ile Leu Gln Pro Ile Leu Gln Arg Leu Ser  
1 5 10 15  
Ala Thr Leu Gln  
20

<210> 203  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 203  
Ile Leu Gln Arg Leu Ser Ala Thr Leu Gln Arg Ile Arg Glu Val Leu  
1 5 10 15  
Arg Thr Glu Leu  
20

<210> 204  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 204  
Arg Ile Arg Glu Val Leu Arg Thr Glu Leu Thr Tyr Leu Gln Tyr Gly  
1 5 10 15  
Trp Ser Tyr Phe  
20

<210> 205  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 205  
Thr Tyr Leu Gln Tyr Gly Trp Ser Tyr Phe His Glu Ala Val Gln Ala  
1 5 10 15  
Val Trp Arg Ser  
20

<210> 206  
<211> 20  
<212> PRT  
<213> Simian Immunodeficiency Virus

<400> 206  
His Glu Ala Val Gln Ala Val Trp Arg Ser Ala Thr Glu Thr Leu Ala  
1 5 10 15  
Gly Ala Trp Gly  
20

<210> 207  
<211> 9

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 207

Ala Met Gln Met Leu Lys Glu Thr Ile  
1 5

&lt;210&gt; 208

&lt;211&gt; 9

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 208

Gly Pro Gly Gln Ala Phe Tyr Ala Thr  
1 5

&lt;210&gt; 209

&lt;211&gt; 764

&lt;212&gt; PRT

&lt;213&gt; Bacillus anthracis

&lt;400&gt; 209

Met	Lys	Lys	Arg	Lys	Val	Leu	Ile	Pro	Leu	Met	Ala	Leu	Ser	Thr	Ile
1				5					10				15		
Leu	Val	Ser	Ser	Thr	Gly	Asn	Leu	Glu	Val	Ile	Gln	Ala	Glu	Val	Lys
				20				25				30			
Gln	Glu	Asn	Arg	Leu	Leu	Asn	Glu	Ser	Glu	Ser	Ser	Ser	Gln	Gly	Leu
	35					40					45				
Leu	Gly	Tyr	Tyr	Phe	Ser	Asp	Leu	Asn	Phe	Gln	Ala	Pro	Met	Val	Val
	50				55			60							
Thr	Ser	Ser	Thr	Thr	Gly	Asp	Leu	Ser	Ile	Pro	Ser	Ser	Glu	Leu	Glu
	65				70				75				80		
Asn	Ile	Pro	Ser	Glu	Asn	Gln	Tyr	Phe	Gln	Ser	Ala	Ile	Trp	Ser	Gly
				85				90				95			
Phe	Ile	Lys	Val	Lys	Lys	Ser	Asp	Glu	Tyr	Thr	Phe	Ala	Thr	Ser	Ala
		100				105					110				
Asp	Asn	His	Val	Thr	Met	Trp	Val	Asp	Asp	Gln	Glu	Val	Ile	Asn	Lys
		115				120					125				
Ala	Ser	Asn	Ser	Asn	Lys	Ile	Arg	Leu	Glu	Lys	Gly	Arg	Leu	Tyr	Gln
		130				135					140				
Ile	Lys	Ile	Gln	Tyr	Gln	Arg	Glu	Asn	Pro	Thr	Glu	Lys	Gly	Ile	Asp
	145				150				155				160		
Phe	Lys	Leu	Tyr	Trp	Thr	Asp	Ser	Gln	Asn	Lys	Lys	Glu	Val	Ile	Ser
		165				170						175			
Ser	Asp	Asn	Leu	Gln	Leu	Pro	Glu	Leu	Lys	Gln	Lys	Ser	Ser	Asn	Ser
		180				185					190				
Arg	Lys	Lys	Arg	Ser	Thr	Ser	Ala	Gly	Pro	Thr	Val	Pro	Asp	Arg	Asp
		195				200					205				
Asn	Asp	Gly	Ile	Pro	Asp	Ser	Leu	Glu	Val	Glu	Gly	Tyr	Thr	Val	Asp
		210				215					220				
Val	Lys	Asn	Lys	Arg	Thr	Phe	Leu	Ser	Pro	Trp	Ile	Ser	Asn	Ile	His
	225					230				235				240	
Glu	Lys	Lys	Gly	Leu	Thr	Lys	Tyr	Lys	Ser	Ser	Pro	Glu	Lys	Trp	Ser
				245				250				255			
Thr	Ala	Ser	Asp	Pro	Tyr	Ser	Asp	Phe	Glu	Lys	Val	Thr	Gly	Arg	Ile
		260				265					270				
Asp	Lys	Asn	Val	Ser	Pro	Glu	Ala	Arg	His	Pro	Leu	Val	Ala	Ala	Tyr
		275				280					285				

Pro Ile Val His Val Asp Met Glu Asn Ile Ile Leu Ser Lys Asn Glu  
 290 295 300  
 Asp Gln Ser Thr Gln Asn Thr Asp Ser Gln Thr Arg Thr Ile Ser Lys  
 305 310 315 320  
 Asn Thr Ser Thr Ser Arg Thr His Thr Ser Glu Val His Gly Asn Ala  
 325 330 335  
 Glu Val His Ala Ser Phe Phe Asp Ile Gly Gly Ser Val Ser Ala Gly  
 340 345 350  
 Phe Ser Asn Ser Asn Ser Ser Thr Val Ala Ile Asp His Ser Leu Ser  
 355 360 365  
 Leu Ala Gly Glu Arg Thr Trp Ala Glu Thr Met Gly Leu Asn Thr Ala  
 370 375 380  
 Asp Thr Ala Arg Leu Asn Ala Asn Ile Arg Tyr Val Asn Thr Gly Thr  
 385 390 395 400  
 Ala Pro Ile Tyr Asn Val Leu Pro Thr Thr Ser Leu Val Leu Gly Lys  
 405 410 415  
 Asn Gln Thr Leu Ala Thr Ile Lys Ala Lys Glu Asn Gln Leu Ser Gln  
 420 425 430  
 Ile Leu Ala Pro Asn Asn Tyr Tyr Pro Ser Lys Asn Leu Ala Pro Ile  
 435 440 445  
 Ala Leu Asn Ala Gln Asp Asp Phe Ser Ser Thr Pro Ile Thr Met Asn  
 450 455 460  
 Tyr Asn Gln Phe Leu Glu Leu Glu Lys Thr Lys Gln Leu Arg Leu Asp  
 465 470 475 480  
 Thr Asp Gln Val Tyr Gly Asn Ile Ala Thr Tyr Asn Phe Glu Asn Gly  
 485 490 495  
 Arg Val Arg Val Asp Thr Gly Ser Asn Trp Ser Glu Val Leu Pro Gln  
 500 505 510  
 Ile Gln Glu Thr Thr Ala Arg Ile Ile Phe Asn Gly Lys Asp Leu Asn  
 515 520 525  
 Leu Val Glu Arg Arg Ile Ala Ala Val Asn Pro Ser Asp Pro Leu Glu  
 530 535 540  
 Thr Thr Lys Pro Asp Met Thr Leu Lys Glu Ala Leu Lys Ile Ala Phe  
 545 550 555 560  
 Gly Phe Asn Glu Pro Asn Gly Asn Leu Gln Tyr Gln Gly Lys Asp Ile  
 565 570 575  
 Thr Glu Phe Asp Phe Asn Phe Asp Gln Gln Thr Ser Gln Asn Ile Lys  
 580 585 590  
 Asn Gln Leu Ala Glu Leu Asn Ala Thr Asn Ile Tyr Thr Val Leu Asp  
 595 600 605  
 Lys Ile Lys Leu Asn Ala Lys Met Asn Ile Leu Ile Arg Asp Lys Arg  
 610 615 620  
 Phe His Tyr Asp Arg Asn Asn Ile Ala Val Gly Ala Asp Glu Ser Val  
 625 630 635 640  
 Val Lys Glu Ala His Arg Glu Val Ile Asn Ser Ser Thr Glu Gly Leu  
 645 650 655  
 Leu Leu Asn Ile Asp Lys Asp Ile Arg Lys Ile Leu Ser Gly Tyr Ile  
 660 665 670  
 Val Glu Ile Glu Asp Thr Glu Gly Leu Lys Glu Val Ile Asn Asp Arg  
 675 680 685  
 Tyr Asp Met Leu Asn Ile Ser Ser Leu Arg Gln Asp Gly Lys Thr Phe  
 690 695 700  
 Ile Asp Phe Lys Lys Tyr Asn Asp Lys Leu Pro Leu Tyr Ile Ser Asn  
 705 710 715 720  
 Pro Asn Tyr Lys Val Asn Val Tyr Ala Val Thr Lys Glu Asn Thr Ile  
 725 730 735  
 Ile Asn Pro Ser Glu Asn Gly Asp Thr Ser Thr Asn Gly Ile Lys Lys  
 740 745 750  
 Ile Leu Ile Phe Ser Lys Lys Gly Tyr Glu Ile Gly  
 755 760

<210> 210  
<211> 588  
<212> PRT  
<213> Ebola virus

<220>  
<221> VARIANT  
<222> 120  
<223> Xaa = Any Amino Acid

<400> 210  
His Gly Phe Arg Phe Glu Val Lys Lys Arg Asp Gly Val Lys Arg Leu  
1 5 10 15  
Glu Glu Leu Leu Pro Ala Val Ser Ser Gly Lys Asn Ile Lys Arg Thr  
20 25 30  
Leu Ala Ala Met Pro Glu Glu Glu Thr Thr Glu Ala Asn Ala Gly Gln  
35 40 45  
Phe Leu Ser Phe Ala Ser Leu Phe Leu Pro Lys Leu Val Val Gly Glu  
50 55 60  
Lys Ala Cys Leu Glu Lys Val Gln Arg Gln Ile Gln Val His Ala Glu  
65 70 75 80  
Gln Gly Leu Ile Gln Tyr Pro Thr Ala Trp Gln Ser Val Gly His Met  
85 90 95  
Met Val Ile Phe Arg Leu Met Arg Thr Asn Phe Leu Ile Lys Phe Leu  
100 105 110  
Leu Ile His Gln Gly Met His Xaa Val Ala Gly His Asp Ala Asn Asp  
115 120 125  
Ala Val Ile Ser Asn Ser Val Ala Gln Ala Arg Phe Ser Gly Leu Leu  
130 135 140  
Ile Val Lys Thr Val Leu Asp His Ile Leu Gln Lys Thr Glu Arg Gly  
145 150 155 160  
Val Arg Leu His Pro Leu Ala Arg Thr Ala Lys Val Lys Asn Glu Val  
165 170 175  
Asn Ser Phe Lys Ala Ala Leu Ser Ser Leu Ala Lys His Gly Glu Tyr  
180 185 190  
Ala Pro Phe Ala Arg Leu Leu Asn Leu Ser Gly Val Asn Asn Leu Glu  
195 200 205  
His Gly Leu Phe Pro Gln Leu Ser Ala Ile Ala Leu Gly Val Ala Thr  
210 215 220  
Ala His Gly Ser Thr Leu Ala Gly Val Asn Val Gly Glu Gln Tyr Gln  
225 230 235 240  
Gln Leu Arg Glu Ala Ala Thr Glu Ala Glu Lys Gln Leu Gln Gln Tyr  
245 250 255  
Ala Glu Ser Arg Glu Leu Asp His Leu Gly Leu Asp Asp Gln Glu Lys  
260 265 270  
Lys Ile Leu Met Asn Phe His Gln Lys Lys Asn Glu Ile Ser Phe Gln  
275 280 285  
Gln Thr Asn Ala Met Val Thr Leu Arg Lys Glu Arg Leu Ala Lys Leu  
290 295 300  
Thr Glu Ala Ile Thr Ala Ala Ser Leu Pro Lys Thr Ser Gly His Tyr  
305 310 315 320  
Asp Asp Asp Asp Ile Pro Phe Pro Gly Pro Ile Asn Asp Asp Asp  
325 330 335  
Asn Pro Gly His Gln Asp Asp Asp Pro Thr Asp Ser Gln Asp Thr Thr  
340 345 350  
Ile Pro Asp Val Val Val Asp Pro Asp Asp Gly Ser Tyr Gly Glu Tyr  
355 360 365  
Gln Ser Tyr Ser Glu Asn Gly Met Asn Ala Pro Asp Asp Leu Val Leu  
370 375 380

Phe Asp Leu Asp Glu Asp Asp Glu Asp Thr Lys Pro Val Pro Asn Arg  
 385 390 395 400  
 Ser Thr Lys Gly Gly Gln Gln Lys Asn Ser Gln Lys Gly Gln His Thr  
 405 410 415  
 Glu Gly Arg Gln Thr Gln Ser Arg Pro Thr Gln Asn Val Pro Gly Pro  
 420 425 430  
 His Arg Thr Ile His His Ala Ser Ala Pro Leu Thr Asp Asn Asp Arg  
 435 440 445  
 Arg Asn Glu Pro Ser Gly Ser Thr Ser Pro Arg Met Leu Thr Pro Ile  
 450 455 460  
 Asn Glu Glu Ala Asp Pro Leu Asp Asp Ala Asp Asp Glu Thr Ser Ser  
 465 470 475 480  
 Leu Pro Pro Leu Glu Ser Asp Asp Glu Glu Gln Asp Arg Gly Thr  
 485 490 495  
 Ser Asn Arg Thr Pro Thr Val Ala Pro Pro Ala Pro Val Tyr Arg Asp  
 500 505 510  
 His Ser Glu Lys Lys Glu Leu Pro Gln Asp Glu Arg Gln Asp Gln Asp  
 515 520 525  
 His Thr Gln Glu Ala Arg Asn Gln Asp Ser Asp Asn Thr Gln Pro Glu  
 530 535 540  
 His Ser Phe Glu Glu Met Tyr Arg His Ile Leu Arg Ser Gln Gly Pro  
 545 550 555 560  
 Phe Asp Ala Val Leu Tyr Tyr His Met Met Lys Asp Glu Pro Val Val  
 565 570 575  
 Phe Ser Thr Ser Asp Gly Lys Glu Tyr Thr Tyr Pro  
 580 585

<210> 211  
<211> 2280  
<212> PRT  
<213> Hepatitis C Virus

<400> 211  
 Met Ser Thr Asn Pro Lys Pro Gln Arg Lys Thr Lys Arg Asn Thr Tyr  
 1 5 10 15  
 Arg Arg Pro Gln Asp Val Lys Phe Pro Gly Gly Gln Ile Val Gly  
 20 25 30  
 Gly Val Tyr Val Leu Pro Arg Arg Gly Pro Thr Leu Gly Val Arg Ala  
 35 40 45  
 Thr Arg Lys Thr Ser Glu Arg Ser Gln Pro Arg Gly Arg Arg Gln Pro  
 50 55 60  
 Ile Pro Lys Ala Arg Arg Pro Glu Gly Arg Ala Trp Ala Gln Pro Gly  
 65 70 75 80  
 Tyr Pro Trp Pro Leu Tyr Gly Asn Glu Gly Leu Gly Trp Ala Gly Trp  
 85 90 95  
 Leu Leu Ser Pro Arg Gly Ser Arg Pro Ser Trp Gly Pro Thr Asp Pro  
 100 105 110  
 Arg Arg Arg Ser Arg Asn Leu Gly Lys Val Ile Asp Thr Leu Thr Cys  
 115 120 125  
 Gly Phe Ala Asp Leu Met Gly Tyr Ile Pro Leu Val Gly Ala Pro Leu  
 130 135 140  
 Gly Gly Ala Ala Arg Ala Leu Ala His Gly Val Arg Val Leu Glu Asp  
 145 150 155 160  
 Gly Val Asn Tyr Ala Thr Gly Asn Leu Pro Gly Cys Ser Phe Ser Ile  
 165 170 175  
 Phe Leu Leu Ala Leu Leu Ser Cys Leu Thr Ile Pro Ala Ser Ala Tyr  
 180 185 190  
 Gln Val Arg Asn Ala Ser Gly Leu Tyr His Val Thr Asn Asp Cys Ser  
 195 200 205

Asn Ser Ser Ile Val Tyr Glu Ala Ala Gly Met Ile Met His Thr Pro  
 210 215 220  
 Gly Cys Val Pro Cys Val Arg Glu Asn Asn Ala Ser Arg Cys Trp Val  
 225 230 235 240  
 Ala Leu Thr Pro Thr Leu Ala Ala Arg Asn Thr Ser Ile Pro Thr Thr  
 245 250 255  
 Thr Ile Arg Arg His Val Asp Leu Leu Val Gly Ala Ala Phe Cys  
 260 265 270  
 Ser Ala Met Tyr Val Gly Asp Leu Cys Gly Ser Val Phe Leu Val Ser  
 275 280 285  
 Gln Leu Phe Thr Phe Ser Pro Arg Arg Tyr Glu Thr Val Gln Asp Cys  
 290 295 300  
 Asn Cys Ser Ile Tyr Pro Gly His Val Ser Gly His Arg Met Ala Trp  
 305 310 315 320  
 Asp Met Met Met Asn Trp Ser Pro Thr Thr Ala Leu Val Val Ser Gln  
 325 330 335  
 Leu Leu Arg Ile Pro Gln Ala Val Val Asp Met Val Ala Gly Ala His  
 340 345 350  
 Trp Gly Val Leu Ala Gly Leu Ala Tyr Tyr Ser Met Val Gly Asn Trp  
 355 360 365  
 Ala Lys Val Leu Ile Val Met Leu Leu Phe Ala Gly Val Asp Gly Val  
 370 375 380  
 Thr Tyr Thr Thr Gly Gly Ser Gln Ala Arg His Thr Gln Ser Val Thr  
 385 390 395 400  
 Ser Phe Phe Thr Gln Gly Pro Ala Gln Arg Ile Gln Leu Ile Asn Thr  
 405 410 415  
 Asn Gly Ser Trp His Ile Asn Arg Thr Ala Leu Asn Cys Asn Glu Ser  
 420 425 430  
 Leu Asn Thr Gly Phe Phe Ala Ala Leu Phe Tyr Ala His Lys Phe Asn  
 435 440 445  
 Ser Ser Gly Cys Pro Glu Arg Met Ala Ser Cys Ser Ser Ile Asp Lys  
 450 455 460  
 Phe Ala Gln Gly Trp Gly Pro Ile Thr Tyr Thr Glu Pro Arg Asp Leu  
 465 470 475 480  
 Asp Gln Arg Pro Tyr Cys Trp His Tyr Ala Pro Arg Gln Cys Gly Ile  
 485 490 495  
 Val Pro Ala Ser Gln Val Cys Gly Pro Val Tyr Cys Phe Thr Pro Ser  
 500 505 510  
 Pro Val Val Val Gly Thr Thr Asp Arg Ser Gly Ala Pro Thr Tyr Asn  
 515 520 525  
 Trp Gly Ala Asn Glu Thr Asp Val Leu Leu Leu Asn Asn Thr Arg Pro  
 530 535 540  
 Pro Gln Gly Asn Trp Phe Gly Cys Thr Trp Met Asn Ser Thr Gly Phe  
 545 550 555 560  
 Thr Lys Thr Cys Gly Gly Pro Pro Cys Asn Ile Gly Gly Val Gly Asn  
 565 570 575  
 Leu Thr Leu Thr Cys Pro Thr Asp Cys Phe Arg Lys His Pro Glu Ala  
 580 585 590  
 Thr Tyr Thr Lys Cys Gly Ser Gly Pro Trp Leu Thr Pro Arg Cys Ile  
 595 600 605  
 Val Asp Tyr Pro Tyr Arg Leu Trp His Tyr Pro Cys Thr Val Asn Phe  
 610 615 620  
 Thr Ile Phe Lys Val Arg Met Tyr Val Gly Val Glu His Arg Leu  
 625 630 635 640  
 Ser Ala Ala Cys Asn Trp Thr Arg Gly Glu Arg Cys Asp Leu Glu Asp  
 645 650 655  
 Arg Asp Arg Ser Glu Leu Ser Pro Leu Leu Leu Ser Thr Thr Glu Trp  
 660 665 670  
 Gln Thr Leu Pro Cys Ser Phe Thr Thr Leu Pro Ala Leu Ser Thr Gly  
 675 680 685

Leu Ile His Leu His Gln Asn Ile Val Asp Val Gln Tyr Leu Tyr Gly  
 690 695 700  
 Ile Gly Ser Ala Val Val Ser Phe Val Ile Lys Trp Glu Tyr Ile Val  
 705 710 715 720  
 Leu Leu Phe Leu Leu Ala Asp Ala Arg Val Cys Ala Cys Leu Trp  
 725 730 735  
 Met Met Leu Leu Ile Ala Gln Ala Glu Ala Ala Leu Glu Asn Leu Val  
 740 745 750  
 Val Leu Asn Ala Ala Ser Leu Ala Gly Ala Asp Gly Ile Leu Ser Phe  
 755 760 765  
 Leu Val Phe Phe Cys Ala Ala Trp Tyr Ile Lys Gly Arg Leu Val Pro  
 770 775 780  
 Gly Ala Ala Tyr Ala Leu Tyr Gly Val Trp Pro Leu Leu Leu Leu  
 785 790 795 800  
 Leu Ala Leu Pro Pro Arg Ala Tyr Ala Met Asp Arg Glu Met Ala Ala  
 805 810 815  
 Ser Cys Gly Gly Val Val Phe Val Gly Leu Ile Leu Leu Thr Leu Ser  
 820 825 830  
 Pro His Tyr Lys Val Phe Leu Ala Arg Leu Ile Trp Trp Leu Gln Tyr  
 835 840 845  
 Phe Ile Thr Arg Ala Glu Ala His Leu Cys Val Trp Val Pro Pro Leu  
 850 855 860  
 Asn Val Arg Gly Gly Arg Asp Ala Ile Ile Leu Leu Thr Cys Ala Ala  
 865 870 875 880  
 His Pro Glu Leu Ile Phe Asp Ile Thr Lys Leu Leu Ala Ile Leu  
 885 890 895  
 Gly Pro Leu Met Val Leu Gln Ala Ala Ile Thr Ala Met Pro Tyr Phe  
 900 905 910  
 Val Arg Ala Gln Gly Leu Ile Arg Ala Cys Met Leu Val Arg Lys Val  
 915 920 925  
 Ala Gly Gly His Tyr Val Gln Met Ala Phe Met Lys Leu Ala Ala Leu  
 930 935 940  
 Thr Gly Thr Tyr Val Tyr Asp His Leu Thr Pro Leu Gln Asp Trp Ala  
 945 950 955 960  
 His Ala Gly Leu Arg Asp Leu Ala Val Ala Val Glu Pro Val Val Phe  
 965 970 975  
 Ser Asp Met Glu Thr Lys Ile Ile Thr Trp Gly Ala Asp Thr Ala Ala  
 980 985 990  
 Cys Gly Asp Ile Ile Leu Gly Leu Pro Val Ser Ala Arg Arg Gly Arg  
 995 1000 1005  
 Glu Ile Leu Leu Gly Pro Ala Asp Ser Ile Glu Gly Gln Gly Trp Arg  
 1010 1015 1020  
 Leu Leu Ala Pro Ile Thr Ala Tyr Ala Gln Gln Thr Arg Gly Leu Leu  
 1025 1030 1035 1040  
 Gly Cys Ile Val Thr Ser Leu Thr Gly Arg Asp Lys Asn Gln Val Glu  
 1045 1050 1055  
 Gly Glu Val Gln Val Val Ser Thr Ala Thr Gln Ser Phe Leu Ala Thr  
 1060 1065 1070  
 Cys Val Asn Gly Val Cys Trp Thr Val Phe His Gly Ala Gly Ser Lys  
 1075 1080 1085  
 Thr Leu Ala Gly Pro Lys Gly Pro Ile Thr Gln Met Tyr Thr Asn Val  
 1090 1095 1100  
 Asp Gln Asp Leu Val Gly Trp His Ala Pro Pro Gly Ala Arg Ser Leu  
 1105 1110 1115 1120  
 Thr Pro Cys Thr Cys Gly Ser Ser Asp Leu Tyr Leu Val Thr Arg His  
 1125 1130 1135  
 Ala Asp Val Ile Pro Val Arg Arg Gly Asp Gly Arg Gly Ser Leu  
 1140 1145 1150  
 Leu Ser Pro Arg Pro Val Ser Tyr Leu Lys Gly Ser Ser Gly Gly Pro  
 1155 1160 1165  
 Leu Leu Cys Pro Ser Gly His Ala Val Gly Ile Phe Arg Ala Ala Val

1170	1175	1180
Cys Thr Arg Gly Val Ala Lys Ala Val Asp Phe Ile Pro Val Glu Ser		
1185	1190	1195
Met Glu Thr Thr Met Arg Ser Pro Val Phe Thr Asp Asn Ser Ser Pro		1200
1205	1210	1215
Pro Ala Val Pro Gln Thr Phe Gln Val Ala His Leu His Ala Pro Thr		
1220	1225	1230
Gly Ser Gly Lys Ser Thr Lys Val Pro Ala Ala Tyr Ala Ala Gln Gly		
1235	1240	1245
Tyr Lys Val Leu Val Leu Asn Pro Ser Val Ala Ala Thr Leu Gly Phe		
1250	1255	1260
Gly Ala Tyr Met Ser Lys Ala His Gly Thr Asp Pro Asn Ile Arg Thr		
1265	1270	1275
Gly Val Arg Thr Ile Thr Thr Gly Ala Pro Ile Thr Tyr Ser Thr Tyr		1280
1285	1290	1295
Gly Lys Phe Leu Ala Asp Gly Gly Cys Ser Gly Gly Ala Tyr Asp Ile		
1300	1305	1310
Ile Ile Cys Asp Glu Cys His Ser Thr Asp Ser Thr Thr Ile Leu Gly		
1315	1320	1325
Ile Gly Thr Val Leu Asp Gln Ala Glu Thr Ala Gly Ala Arg Leu Val		
1330	1335	1340
Val Leu Ala Thr Ala Thr Pro Pro Gly Ser Val Thr Val Pro His Pro		
1345	1350	1355
Asn Ile Glu Glu Val Ala Leu Ser Asn Thr Gly Glu Ile Pro Phe Tyr		
1365	1370	1375
Gly Lys Ala Ile Pro Leu Glu Ala Ile Lys Gly Gly Arg His Leu Ile		
1380	1385	1390
Phe Cys His Ser Lys Lys Cys Asp Glu Leu Ala Ala Lys Leu Ser		
1395	1400	1405
Gly Leu Gly Ile Asn Ala Val Ala Tyr Tyr Arg Gly Leu Asp Val Ser		
1410	1415	1420
Val Ile Pro Thr Ser Gly Asp Val Val Ile Val Ala Thr Asp Ala Leu		
1425	1430	1435
Met Thr Gly Tyr Thr Gly Asp Phe Asp Ser Val Ile Asp Cys Asn Thr		
1445	1450	1455
Cys Val Thr Gln Thr Val Asp Phe Ser Leu Asp Pro Thr Phe Thr Ile		
1460	1465	1470
Glu Thr Thr Thr Val Pro Gln Asp Ala Val Ser Arg Ser Gln Arg Arg		
1475	1480	1485
Gly Arg Thr Gly Arg Gly Gly Ile Tyr Arg Phe Val Thr Pro		
1490	1495	1500
Gly Glu Arg Pro Ser Gly Met Phe Asp Ser Ser Val Leu Cys Glu Cys		
1505	1510	1515
Tyr Asp Ala Gly Cys Ala Trp Tyr Glu Leu Thr Pro Ala Glu Thr Thr		
1525	1530	1535
Val Arg Leu Arg Ala Tyr Leu Asn Thr Pro Gly Leu Pro Val Cys Gln		
1540	1545	1550
Asp His Leu Glu Phe Trp Glu Ser Val Phe Thr Gly Leu Thr His Ile		
1555	1560	1565
Asp Ala His Phe Leu Ser Gln Thr Lys Gln Ala Gly Asp Asn Phe Pro		
1570	1575	1580
Tyr Leu Val Ala Tyr Gln Ala Thr Val Cys Ala Arg Ala Gln Ala Pro		
1585	1590	1595
Pro Pro Ser Trp Asp Gln Met Trp Lys Cys Leu Ile Arg Leu Lys Pro		
1605	1610	1615
Thr Leu His Gly Pro Thr Pro Leu Leu Tyr Arg Leu Gly Ala Val Gln		
1620	1625	1630
Asn Glu Ile Thr Leu Thr His Pro Ile Thr Lys Phe Ile Met Ala Cys		
1635	1640	1645
Met Ser Ala Asp Leu Glu Val Val Thr Ser Thr Trp Val Leu Val Gly		
1650	1655	1660

Gly Val Leu Ala Ala Leu Ala Ala Tyr Cys Leu Thr Thr Gly Ser Val  
 1665 1670 1675 1680  
 Val Ile Val Gly Arg Ile Ile Leu Ser Gly Arg Pro Ala Val Val Pro  
 1685 1690 1695  
 Asp Arg Glu Val Leu Tyr Arg Glu Phe Asp Glu Met Glu Glu Cys Ala  
 1700 1705 1710  
 Ser His Leu Pro Tyr Ile Glu Gln Gly Met Gln Leu Ala Glu Gln Phe  
 1715 1720 1725  
 Lys Gln Lys Ala Leu Gly Leu Leu Gln Thr Ala Thr Lys Gln Ala Glu  
 1730 1735 1740  
 Ala Ala Ala Pro Val Val Glu Ser Arg Trp Arg Ala Leu Glu Ala Phe  
 1745 1750 1755 1760  
 Trp Ala Lys His Met Trp Asn Phe Ile Ser Gly Ile Gln Tyr Leu Ala  
 1765 1770 1775  
 Gly Leu Ser Thr Leu Pro Gly Asn Pro Ala Ile Ala Ser Leu Met Ala  
 1780 1785 1790  
 Phe Thr Ala Ser Ile Thr Ser Pro Leu Thr Thr Gln Asn Thr Leu Leu  
 1795 1800 1805  
 Phe Asn Ile Leu Gly Gly Trp Val Ala Ala Gln Leu Ala Pro Pro Ser  
 1810 1815 1820  
 Ala Ala Ser Ala Phe Val Gly Ala Gly Ile Ala Gly Ala Ala Ile Gly  
 1825 1830 1835 1840  
 Ser Ile Gly Leu Gly Lys Val Leu Val Asp Ile Leu Ala Gly Tyr Gly  
 1845 1850 1855  
 Ala Gly Val Ala Gly Ala Leu Val Ala Phe Lys Val Met Ser Gly Glu  
 1860 1865 1870  
 Ala Pro Ser Ala Glu Asp Leu Val Asn Leu Leu Pro Ala Ile Leu Ser  
 1875 1880 1885  
 Pro Gly Ala Leu Val Val Gly Val Val Cys Ala Ala Ile Leu Arg Arg  
 1890 1895 1900  
 His Val Gly Pro Gly Glu Gly Ala Val Gln Trp Met Asn Arg Leu Ile  
 1905 1910 1915 1920  
 Ala Phe Ala Ser Arg Gly Asn His Val Ser Pro Thr His Tyr Val Pro  
 1925 1930 1935  
 Glu Ser Asp Ala Ala Ala Arg Val Thr Gln Ile Leu Ser Ser Leu Thr  
 1940 1945 1950  
 Ile Thr Gln Leu Leu Lys Arg Leu His Gln Trp Ile Asn Glu Asp Cys  
 1955 1960 1965  
 Ser Thr Pro Cys Ser Gly Ser Trp Leu Lys Asp Val Trp Asp Trp Ile  
 1970 1975 1980  
 Cys Thr Val Leu Thr Asp Phe Lys Thr Trp Leu Gln Ser Lys Leu Leu  
 1985 1990 1995 2000  
 Pro Lys Leu Pro Gly Val Pro Phe Phe Ser Cys Gln Arg Gly Tyr Lys  
 2005 2010 2015  
 Gly Val Trp Arg Gly Asp Gly Ile Met Gln Thr Thr Cys Pro Cys Gly  
 2020 2025 2030  
 Ala Gln Ile Thr Gly His Val Lys Asn Gly Ser Met Arg Ile Val Gly  
 2035 2040 2045  
 Pro Lys Thr Cys Ser Asn Thr Trp His Gly Thr Phe Pro Ile Asn Ala  
 2050 2055 2060  
 Tyr Thr Thr Gly Pro Cys Thr Pro Ser Pro Ala Pro Asn Tyr Ser Arg  
 2065 2070 2075 2080  
 Ala Leu Trp Arg Val Ala Ala Glu Glu Tyr Val Glu Ile Thr Arg Val  
 2085 2090 2095  
 Gly Asp Phe His Tyr Val Thr Gly Met Thr Thr Asp Asn Val Lys Cys  
 2100 2105 2110  
 Pro Cys Gln Val Pro Ala Pro Glu Phe Phe Thr Glu Leu Asp Gly Val  
 2115 2120 2125  
 Arg Leu His Arg Tyr Ala Pro Ala Cys Arg Pro Leu Leu Arg Glu Asp  
 2130 2135 2140  
 Val Thr Phe Gln Val Gly Leu Asn Gln Tyr Leu Val Gly Ser Gln Leu

2145	2150	2155	2160
Pro Cys Glu Pro Glu Pro Asp Val Ala Val Leu Thr Ser Met Leu Thr			
2165	2170	2175	
Asp Pro Ser His Ile Thr Ala Glu Thr Ala Lys Arg Arg Leu Ala Arg			
2180	2185	2190	
Gly Ser Pro Pro Ser Leu Ala Ser Ser Ser Ala Ser Gln Leu Ser Ala			
2195	2200	2205	
Pro Ser Leu Lys Ala Thr Cys Thr Thr His His Asp Ser Pro Asp Ala			
2210	2215	2220	
Asp Leu Ile Glu Ala Asn Leu Leu Trp Arg Gln Glu Met Gly Gly Asn			
2225	2230	2235	2240
Ile Thr Arg Val Glu Ser Glu Asn Lys Val Val Ile Leu Asp Ser Phe			
2245	2250	2255	
Asp Pro Leu Arg Ala Glu Glu Asp Glu Arg Glu Val Ser Val Ala Ala			
2260	2265	2270	
Glu Ile Leu Arg Lys Ser Lys Lys			
2275	2280		

&lt;210&gt; 212

&lt;211&gt; 128

&lt;212&gt; PRT

&lt;213&gt; Homo sapiens

&lt;400&gt; 212

Met Arg Thr Leu Asp Leu Ile Asp Glu Ala Tyr Gly Leu Asp Phe Tyr			
1	5	10	15
Ile Leu Lys Thr Pro Lys Glu Asp Leu Cys Ser Lys Phe Gly Met Glu			
20	25	30	
Leu Lys Arg Gly Met Leu Leu Arg Leu Ala Arg Gln Asp Pro Gln Leu			
35	40	45	
His Pro Glu Asp Pro Glu Arg Arg Ala Ala Ile Tyr Asp Lys Tyr Lys			
50	55	60	
Glu Phe Ala Ile Pro Glu Glu Ala Glu Trp Val Gly Leu Thr Leu			
65	70	75	80
Glu Glu Ala Ile Glu Lys Gln Arg Leu Leu Glu Glu Lys Asp Pro Val			
85	90	95	
Pro Leu Phe Lys Ile Tyr Val Ala Glu Leu Ile Gln Gln Leu Gln Gln			
100	105	110	
Gln Ala Leu Ser Glu Pro Ala Val Val Gln Lys Thr Ala Ser Gly Gln			
115	120	125	

&lt;210&gt; 213

&lt;211&gt; 1255

&lt;212&gt; PRT

&lt;213&gt; Homo sapiens

&lt;400&gt; 213

Met Glu Leu Ala Ala Leu Cys Arg Trp Gly Leu Leu Leu Ala Leu Leu			
1	5	10	15
Pro Pro Gly Ala Ala Ser Thr Gln Val Cys Thr Gly Thr Asp Met Lys			
20	25	30	
Leu Arg Leu Pro Ala Ser Pro Glu Thr His Leu Asp Met Leu Arg His			
35	40	45	
Leu Tyr Gln Gly Cys Gln Val Val Gln Gly Asn Leu Glu Leu Thr Tyr			
50	55	60	
Leu Pro Thr Asn Ala Ser Leu Ser Phe Leu Gln Asp Ile Gln Glu Val			
65	70	75	80
Gln Gly Tyr Val Leu Ile Ala His Asn Gln Val Arg Gln Val Pro Leu			
85	90	95	

Gln Arg Leu Arg Ile Val Arg Gly Thr Gln Leu Phe Glu Asn Tyr  
 100, 105 110  
 Ala Leu Ala Val Leu Asp Asn Gly Asp Pro Leu Asn Asn Thr Thr Pro  
 115 120 125  
 Val Thr Gly Ala Ser Pro Gly Gly Leu Arg Glu Leu Gln Leu Arg Ser  
 130 135 140  
 Leu Thr Glu Ile Leu Lys Gly Gly Val Leu Ile Gln Arg Asn Pro Gln  
 145 150 155 160  
 Leu Cys Tyr Gln Asp Thr Ile Leu Trp Lys Asp Ile Phe His Lys Asn  
 165 170 175  
 Asn Gln Leu Ala Leu Thr Leu Ile Asp Thr Asn Arg Ser Arg Ala Cys  
 180 185 190  
 His Pro Cys Ser Pro Met Cys Lys Gly Ser Arg Cys Trp Gly Glu Ser  
 195 200 205  
 Ser Glu Asp Cys Gln Ser Leu Thr Arg Thr Val Cys Ala Gly Gly Cys  
 210 215 220  
 Ala Arg Cys Lys Gly Pro Leu Pro Thr Asp Cys Cys His Glu Gln Cys  
 225 230 235 240  
 Ala Ala Gly Cys Thr Gly Pro Lys His Ser Asp Cys Leu Ala Cys Leu  
 245 250 255  
 His Phe Asn His Ser Gly Ile Cys Glu Leu His Cys Pro Ala Leu Val  
 260 265 270  
 Thr Tyr Asn Thr Asp Thr Phe Glu Ser Met Pro Asn Pro Glu Gly Arg  
 275 280 285  
 Tyr Thr Phe Gly Ala Ser Cys Val Thr Ala Cys Pro Tyr Asn Tyr Leu  
 290 295 300  
 Ser Thr Asp Val Gly Ser Cys Thr Leu Val Cys Pro Leu His Asn Gln  
 305 310 315 320  
 Glu Val Thr Ala Glu Asp Gly Thr Gln Arg Cys Glu Lys Cys Ser Lys  
 325 330 335  
 Pro Cys Ala Arg Val Cys Tyr Gly Leu Gly Met Glu His Leu Arg Glu  
 340 345 350  
 Val Arg Ala Val Thr Ser Ala Asn Ile Gln Glu Phe Ala Gly Cys Lys  
 355 360 365  
 Lys Ile Phe Gly Ser Leu Ala Phe Leu Pro Glu Ser Phe Asp Gly Asp  
 370 375 380  
 Pro Ala Ser Asn Thr Ala Pro Leu Gln Pro Glu Gln Leu Gln Val Phe  
 385 390 395 400  
 Glu Thr Leu Glu Ile Thr Gly Tyr Leu Tyr Ile Ser Ala Trp Pro  
 405 410 415  
 Asp Ser Leu Pro Asp Leu Ser Val Phe Gln Asn Leu Gln Val Ile Arg  
 420 425 430  
 Gly Arg Ile Leu His Asn Gly Ala Tyr Ser Leu Thr Leu Gln Gly Leu  
 435 440 445  
 Gly Ile Ser Trp Leu Gly Leu Arg Ser Leu Arg Glu Leu Gly Ser Gly  
 450 455 460  
 Leu Ala Leu Ile His His Asn Thr His Leu Cys Phe Val His Thr Val  
 465 470 475 480  
 Pro Trp Asp Gln Leu Phe Arg Asn Pro His Gln Ala Leu Leu His Thr  
 485 490 495  
 Ala Asn Arg Pro Glu Asp Glu Cys Val Gly Glu Gly Leu Ala Cys His  
 500 505 510  
 Gln Leu Cys Ala Arg Gly His Cys Trp Gly Pro Gly Pro Thr Gln Cys  
 515 520 525  
 Val Asn Cys Ser Gln Phe Leu Arg Gly Gln Glu Cys Val Glu Glu Cys  
 530 535 540  
 Arg Val Leu Gln Gly Leu Pro Arg Glu Tyr Val Asn Ala Arg His Cys  
 545 550 555 560  
 Leu Pro Cys His Pro Glu Cys Gln Pro Gln Asn Gly Ser Val Thr Cys  
 565 570 575  
 Phe Gly Pro Glu Ala Asp Gln Cys Val Ala Cys Ala His Tyr Lys Asp

580	585	590
Pro Pro Phe Cys Val Ala Arg Cys	Pro Ser Gly Val Lys	Pro Asp Leu
595	600	605
Ser Tyr Met Pro Ile Trp Lys Phe	Pro Asp Glu Glu Gly Ala Cys Gln	
610	615	620
Pro Cys Pro Ile Asn Cys Thr His	Ser Cys Val Asp Leu Asp Asp Lys	
625	630	635
Gly Cys Pro Ala Glu Gln Arg Ala Ser	Pro Leu Thr Ser Ile Ile Ser	
645	650	655
Ala Val Val Gly Ile Leu Leu Val Val Val	Leu Gly Val Val Phe Gly	
660	665	670
Ile Leu Ile Lys Arg Arg Gln Gln	Lys Ile Arg Lys Tyr Thr Met Arg	
675	680	685
Arg Leu Leu Gln Glu Thr Glu	Leu Val Glu Pro Leu Thr Pro Ser Gly	
690	695	700
Ala Met Pro Asn Gln Ala Gln Met Arg	Ile Leu Lys Glu Thr Glu Leu	
705	710	715
Arg Lys Val Lys Val Leu Gly Ser	Gly Ala Phe Gly Thr Val Tyr Lys	
725	730	735
Gly Ile Trp Ile Pro Asp Gly Glu	Asn Val Lys Ile Pro Val Ala Ile	
740	745	750
Lys Val Leu Arg Glu Asn Thr Ser	Pro Lys Ala Asn Lys Glu Ile Leu	
755	760	765
Asp Glu Ala Tyr Val Met Ala Gly	Val Gly Ser Pro Tyr Val Ser Arg	
770	775	780
Leu Leu Gly Ile Cys Leu Thr Ser	Thr Val Gln Leu Val Thr Gln Leu	
785	790	795
Met Pro Tyr Gly Cys Leu Leu Asp	His Val Arg Glu Asn Arg Gly Arg	
805	810	815
Leu Gly Ser Gln Asp Leu Leu Asn	Trp Cys Met Gln Ile Ala Lys Gly	
820	825	830
Met Ser Tyr Leu Glu Asp Val Arg	Leu Val His Arg Asp Leu Ala Ala	
835	840	845
Arg Asn Val Leu Val Lys Ser	Pro Asn His Val Lys Ile Thr Asp Phe	
850	855	860
Gly Leu Ala Arg Leu Leu Asp	Ile Asp Glu Thr Glu Tyr His Ala Asp	
865	870	875
Gly Gly Lys Val Pro Ile Lys Trp	Met Ala Leu Glu Ser Ile Leu Arg	
885	890	895
Arg Arg Phe Thr His Gln Ser Asp	Val Trp Ser Tyr Gly Val Thr Val	
900	905	910
Trp Glu Leu Met Thr Phe Gly	Ala Lys Pro Tyr Asp Gly Ile Pro Ala	
915	920	925
Arg Glu Ile Pro Asp Leu Leu	Glu Lys Gly Glu Arg Leu Pro Gln Pro	
930	935	940
Pro Ile Cys Thr Ile Asp Val Tyr	Met Ile Met Val Lys Cys Trp Met	
945	950	955
Ile Asp Ser Glu Cys Arg Pro Arg	Phe Arg Glu Leu Val Ser Glu Phe	
965	970	975
Ser Arg Met Ala Arg Asp Pro Gln	Arg Phe Val Val Ile Gln Asn Glu	
980	985	990
Asp Leu Gly Pro Ala Ser Pro	Leu Asp Ser Thr Phe Tyr Arg Ser Leu	
995	1000	1005
Leu Glu Asp Asp Met Gly Asp	Leu Val Asp Ala Glu Glu Tyr Leu	
1010	1015	1020
Val Pro Gln Gln Gly Phe	Phe Cys Pro Asp Pro Ala Pro Gly Ala Gly	
1025	1030	1035
Gly Met Val His His Arg His	Arg Ser Ser Ser Thr Arg Ser Gly Gly	
1045	1050	1055
Gly Asp Leu Thr Leu Gly Leu Glu	Pro Ser Glu Glu Ala Pro Arg	
1060	1065	1070

Ser Pro Leu Ala Pro Ser Glu Gly Ala Gly Ser Asp Val Phe Asp Gly  
 1075 1080 1085  
 Asp Leu Gly Met Gly Ala Ala Lys Gly Leu Gln Ser Leu Pro Thr His  
 1090 1095 1100  
 Asp Pro Ser Pro Leu Gln Arg Tyr Ser Glu Asp Pro Thr Val Pro Leu  
 1105 1110 1115 1120  
 Pro Ser Glu Thr Asp Gly Tyr Val Ala Pro Leu Thr Cys Ser Pro Gln  
 1125 1130 1135  
 Pro Glu Tyr Val Asn Gln Pro Asp Val Arg Pro Gln Pro Pro Ser Pro  
 1140 1145 1150  
 Arg Glu Gly Pro Leu Pro Ala Ala Arg Pro Ala Gly Ala Thr Leu Glu  
 1155 1160 1165  
 Arg Pro Lys Thr Leu Ser Pro Gly Lys Asn Gly Val Val Lys Asp Val  
 1170 1175 1180  
 Phe Ala Phe Gly Gly Ala Val Glu Asn Pro Glu Tyr Leu Thr Pro Gln  
 1185 1190 1195 1200  
 Gly Gly Ala Ala Pro Gln Pro His Pro Pro Pro Ala Phe Ser Pro Ala  
 1205 1210 1215  
 Phe Asp Asn Leu Tyr Tyr Trp Asp Gln Asp Pro Pro Glu Arg Gly Ala  
 1220 1225 1230  
 Pro Pro Ser Thr Phe Lys Gly Thr Pro Thr Ala Glu Asn Pro Glu Tyr  
 1235 1240 1245  
 Leu Gly Leu Asp Val Pro Val  
 1250 1255

&lt;210&gt; 214

&lt;211&gt; 574

&lt;212&gt; PRT

&lt;213&gt; Respiratory Syncytial Virus

&lt;400&gt; 214

Met Glu Leu Leu Ile Leu Lys Ala Asn Ala Ile Thr Thr Ile Leu Thr  
 1 5 10 15  
 Ala Val Thr Phe Cys Phe Ala Ser Gly Gln Asn Ile Thr Glu Glu Phe  
 20 25 30  
 Tyr Gln Ser Thr Cys Ser Ala Val Ser Lys Gly Tyr Leu Ser Ala Leu  
 35 40 45  
 Arg Thr Gly Trp Tyr Thr Ser Val Ile Thr Ile Glu Leu Ser Asn Ile  
 50 55 60  
 Lys Glu Asn Lys Cys Asn Gly Thr Asp Ala Lys Val Lys Leu Ile Lys  
 65 70 75 80  
 Gln Glu Leu Asp Lys Tyr Lys Asn Ala Val Thr Glu Leu Gln Leu Leu  
 85 90 95

Met Gln Ser Thr Pro Pro Thr Asn Asn Arg Ala Arg Arg Glu Leu Pro  
 100 105 110  
 Arg Phe Met Asn Tyr Thr Leu Asn Asn Ala Lys Lys Thr Asn Val Thr  
 115 120 125  
 Leu Ser Lys Lys Arg Lys Arg Arg Phe Leu Gly Phe Leu Leu Gly Val  
 130 135 140  
 Gly Ser Ala Ile Ala Ser Gly Val Ala Val Ser Lys Val Leu His Leu  
 145 150 155 160  
 Glu Gly Glu Val Asn Lys Ile Lys Ser Ala Leu Leu Ser Thr Asn Lys  
 165 170 175  
 Ala Val Val Ser Leu Ser Asn Gly Val Ser Val Leu Thr Ser Lys Val  
 180 185 190  
 Leu Asp Leu Lys Asn Tyr Ile Asp Lys Gln Leu Leu Pro Ile Val Asn  
 195 200 205  
 Lys Gln Ser Cys Ser Ile Ser Asn Ile Glu Thr Val Ile Glu Phe Gln  
 210 215 220

Gln Lys Asn Asn Arg Leu Leu Glu Ile Thr Arg Glu Phe Ser Val Asn  
 225 230 235 240  
 Ala Gly Val Thr Thr Pro Val Ser Thr Tyr Met Leu Thr Asn Ser Glu  
 245 250 255  
 Leu Leu Ser Leu Ile Asn Asp Met Pro Ile Thr Asn Asp Gln Lys Lys  
 260 265 270  
 Leu Met Ser Asn Asn Val Gln Ile Val Arg Gln Gln Ser Tyr Ser Ile  
 275 280 285  
 Met Ser Ile Ile Lys Glu Glu Val Leu Ala Tyr Val Val Gln Leu Pro  
 290 295 300  
 Leu Tyr Gly Val Ile Asp Thr Pro Cys Trp Lys Leu His Thr Ser Pro  
 305 310 315 320  
 Leu Cys Thr Thr Asn Thr Lys Glu Gly Ser Asn Ile Cys Leu Thr Arg  
 325 330 335  
 Thr Asp Arg Gly Trp Tyr Cys Asp Asn Ala Gly Ser Val Ser Phe Phe  
 340 345 350  
 Pro Gln Ala Glu Thr Cys Lys Val Gln Ser Asn Arg Val Phe Cys Asp  
 355 360 365  
 Thr Met Asn Ser Leu Thr Leu Pro Ser Glu Ile Asn Leu Cys Asn Val  
 370 375 380  
 Asp Ile Phe Asn Pro Lys Tyr Asp Cys Lys Ile Met Thr Ser Lys Thr  
 385 390 395 400  
 Asp Val Ser Ser Ser Val Ile Thr Ser Leu Gly Ala Ile Val Ser Cys  
 405 410 415  
 Tyr Gly Lys Thr Lys Cys Thr Ala Ser Asn Lys Asn Arg Gly Ile Ile  
 420 425 430  
 Lys Thr Phe Ser Asn Gly Cys Asp Tyr Val Ser Asn Lys Gly Met Asp  
 435 440 445  
 Thr Val Ser Val Gly Asn Thr Leu Tyr Tyr Val Asn Lys Gln Glu Gly  
 450 455 460  
 Lys Ser Leu Tyr Val Lys Gly Glu Pro Ile Ile Asn Phe Tyr Asp Pro  
 465 470 475 480  
 Leu Val Phe Pro Ser Asp Glu Phe Asp Ala Ser Ile Ser Gln Val Asn  
 485 490 495  
 Glu Lys Ile Asn Gln Ser Leu Ala Phe Ile Arg Lys Ser Asp Glu Leu  
 500 505 510  
 Leu His Asn Val Asn Ala Gly Lys Ser Thr Thr Asn Ile Met Ile Thr  
 515 520 525  
 Thr Ile Ile Ile Val Ile Ile Val Ile Leu Leu Ser Leu Ile Ala Val  
 530 535 540  
 Gly Leu Leu Leu Tyr Cys Lys Ala Arg Ser Thr Pro Val Thr Leu Ser  
 545 550 555 560  
 Lys Asp Gln Leu Ser Gly Ile Asn Asn Ile Ala Phe Ser Asn  
 565 570

<210> 215  
 <211> 151  
 <212> PRT  
 <213> Human Immunodeficiency Virus 2

<400> 215  
 Asp Val Val Lys Arg Gln Gln Glu Leu Leu Arg Leu Thr Val Trp Gly  
 1 5 10 15  
 Thr Lys Asn Leu Gln Ala Arg Val Thr Ala Ile Glu Lys Tyr Leu Lys  
 20 25 30  
 Asp Gln Ala His Val Asn Ser Trp Gly Cys Ala Phe Arg Gln Val Cys  
 35 40 45  
 His Thr Thr Val Pro Trp Val Asn Asp Thr Leu Thr Pro Asp Trp Asp  
 50 55 60

Asn Met Thr Trp Gln Glu Trp Glu Glu Lys Val Arg Tyr Leu Glu Ala  
65 70 75 80  
Asn Ile Ser Gln Ser Leu Glu Gln Ala Gln Ile Leu Gln Glu Lys Asn  
85 90 95  
Met Tyr Glu Leu Gln Lys Leu Asn Ser Trp Asp Ile Phe Gly Asn Trp  
100 105 110  
Phe Asp Leu Thr Ser Trp Val Lys Tyr Ile Gln Tyr Gly Val Cys Ile  
115 120 125  
Ile Val Gly Ile Val Ala Leu Arg Ile Val Ile Tyr Val Val Gln Met  
130 135 140  
Leu Ser Arg Leu Arg Lys Gly  
145 150

&lt;210&gt; 216

&lt;211&gt; 522

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 216

Met Gly Ala Arg Asn Ser Val Leu Arg Gly Lys Lys Ala Asp Glu Leu  
1 5 10 15  
Glu Arg Ile Arg Leu Arg Pro Gly Gly Lys Lys Tyr Arg Leu Lys  
20 25 30  
His Ile Val Trp Ala Ala Asn Lys Leu Asp Arg Phe Gly Leu Ala Glu  
35 40 45  
Ser Leu Leu Glu Ser Lys Glu Gly Cys Gln Lys Ile Leu Thr Val Leu  
50 55 60  
Asp Pro Met Val Pro Thr Gly Ser Glu Asn Leu Lys Ser Leu Phe Asn  
65 70 75 80  
Thr Val Cys Val Ile Trp Cys Ile His Ala Glu Glu Lys Val Lys Asp  
85 90 95  
Thr Glu Gly Ala Lys Gln Ile Val Arg Arg His Leu Val Ala Glu Thr  
100 105 110  
Gly Thr Ala Glu Lys Met Pro Ser Thr Ser Arg Pro Thr Ala Pro Ser  
115 120 125  
Ser Glu Lys Gly Gly Asn Tyr Pro Val Gln His Val Gly Gly Asn Tyr  
130 135 140  
Thr His Ile Pro Leu Ser Pro Arg Thr Leu Asn Ala Trp Val Lys Leu  
145 150 155 160  
Val Glu Glu Lys Lys Phe Gly Ala Glu Val Val Pro Gly Phe Gln Ala  
165 170 175  
Leu Ser Glu Gly Cys Thr Pro Tyr Asp Ile Asn Gln Met Leu Asn Cys  
180 185 190  
Val Gly Asp His Gln Ala Ala Met Gln Ile Ile Arg Glu Ile Ile Asn  
195 200 205  
Glu Glu Ala Ala Glu Trp Asp Val Gln His Pro Ile Pro Gly Pro Leu  
210 215 220  
Pro Ala Gly Gln Leu Arg Glu Pro Arg Gly Ser Asp Ile Ala Gly Thr  
225 230 235 240  
Thr Ser Thr Val Glu Glu Gln Ile Gln Trp Met Phe Arg Pro Gln Asn  
245 250 255  
Pro Val Pro Val Gly Asn Ile Tyr Arg Arg Trp Ile Gln Ile Gly Leu  
260 265 270  
Gln Lys Cys Val Arg Met Tyr Asn Pro Thr Asn Ile Leu Asp Ile Lys  
275 280 285  
Gln Gly Pro Lys Glu Pro Phe Gln Ser Tyr Val Asp Arg Phe Tyr Lys  
290 295 300  
Ser Leu Arg Ala Glu Gln Thr Asp Pro Ala Val Lys Asn Trp Met Thr  
305 310 315 320  
Gln Thr Leu Leu Val Gln Asn Ala Asn Pro Asp Cys Lys Leu Val Leu

	325	330	335												
Lys	Gly	Leu	Gly	Met	Asn	Pro	Thr	Leu	Glu	Glu	Met	Leu	Thr	Ala	Cys
				340		345						350			
Gln	Gly	Val	Gly	Gly	Pro	Gly	Gln	Lys	Ala	Arg	Leu	Met	Ala	Glu	Ala
							355		360			365			
Leu	Lys	Glu	Val	Ile	Gly	Pro	Ala	Pro	Ile	Pro	Phe	Ala	Ala	Ala	Gln
						370		375			380				
Gln	Arg	Lys	Ala	Phe	Lys	Cys	Trp	Asn	Cys	Gly	Lys	Glu	Gly	His	Ser
						385		390			395			400	
Ala	Arg	Gln	Cys	Arg	Ala	Pro	Arg	Arg	Gln	Gly	Cys	Trp	Lys	Cys	Gly
						405		410			415				
Lys	Pro	Gly	His	Ile	Met	Thr	Asn	Cys	Pro	Asp	Arg	Gln	Ala	Gly	Phe
						420		425			430				
Leu	Gly	Leu	Gly	Pro	Trp	Gly	Lys	Lys	Pro	Arg	Asn	Phe	Pro	Val	Ala
						435		440			445				
Gln	Val	Pro	Gln	Gly	Leu	Thr	Pro	Thr	Ala	Pro	Pro	Val	Asp	Pro	Ala
						450		455			460				
Val	Asp	Leu	Leu	Glu	Lys	Tyr	Met	Gln	Gln	Gly	Lys	Arg	Gln	Arg	Glu
						465		470			475			480	
Gln	Arg	Glu	Arg	Pro	Tyr	Lys	Glu	Val	Thr	Glu	Asp	Leu	Leu	His	Leu
						485		490			495				
Glu	Gln	Gly	Glu	Thr	Pro	Tyr	Arg	Glu	Pro	Pro	Thr	Glu	Asp	Leu	Leu
						500		505			510				
His	Leu	Asn	Ser	Leu	Phe	Gly	Lys	Asp	Gln						
					515		520								

&lt;210&gt; 217

&lt;211&gt; 860

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus 2

&lt;400&gt; 217

Met	Glu	Pro	Gly	Arg	Asn	Gln	Leu	Phe	Val	Val	Ile	Leu	Leu	Thr	Ser
						1	5		10		15				
Ala	Cys	Leu	Val	Tyr	Cys	Ser	Gln	Tyr	Val	Thr	Val	Phe	Tyr	Gly	Ile
						20		25			30				
Pro	Ala	Trp	Lys	Asn	Ala	Ser	Ile	Pro	Leu	Phe	Cys	Ala	Thr	Lys	Asn
						35		40			45				
Arg	Asp	Thr	Trp	Gly	Thr	Ile	Gln	Cys	Leu	Pro	Asp	Asn	Asp	Asp	Tyr
						50		55			60				
Gln	Glu	Ile	Ile	Leu	Asn	Val	Thr	Glu	Ala	Phe	Asp	Ala	Trp	Asn	Asn
						65		70			75		80		
Thr	Val	Thr	Glu	Gln	Ala	Val	Glu	Asp	Val	Trp	His	Leu	Phe	Glu	Thr
						85		90			95				
Ser	Ile	Lys	Pro	Cys	Val	Lys	Leu	Thr	Pro	Leu	Cys	Val	Ala	Met	Asn
						100		105			110				
Cys	Ser	Arg	Val	Gln	Gly	Asn	Thr	Thr	Thr	Pro	Asn	Pro	Arg	Thr	Ser
						115		120			125				
Ser	Ser	Thr	Thr	Ser	Arg	Pro	Pro	Thr	Ser	Ala	Ala	Ser	Ile	Ile	Asn
						130		135			140				
Glu	Thr	Ser	Asn	Cys	Ile	Glu	Asn	Asn	Thr	Cys	Ala	Gly	Leu	Gly	Tyr
						145		150			155		160		
Glu	Glu	Met	Met	Gln	Cys	Glu	Phe	Asn	Met	Lys	Gly	Leu	Glu	Gln	Asp
						165		170			175				
Lys	Lys	Arg	Arg	Tyr	Lys	Asp	Thr	Trp	Tyr	Leu	Glu	Asp	Val	Val	Cys
						180		185			190				
Asp	Asn	Thr	Thr	Ala	Gly	Thr	Cys	Tyr	Met	Arg	His	Cys	Asn	Thr	Ser
						195		200			205				
Ile	Ile	Lys	Glu	Ser	Cys	Asp	Lys	His	Tyr	Trp	Asp	Ala	Met	Arg	Phe
						210		215			220				

Arg Tyr Cys Ala Pro Pro Gly Phe Ala Leu Leu Arg Cys Asn Asp Thr  
 225 230 235 240  
 Asn Tyr Ser Gly Phe Glu Pro Lys Cys Thr Lys Val Val Ala Ala Ser  
 245 250 255  
 Cys Thr Arg Met Met Glu Thr Gln Thr Ser Thr Trp Phe Gly Phe Asn  
 260 265 270  
 Gly Thr Arg Ala Glu Asn Arg Thr Tyr Ile Tyr Trp His Gly Arg Asp  
 275 280 285  
 Asn Arg Thr Ile Ile Ser Leu Asn Lys Tyr Tyr Asn Leu Thr Met Arg  
 290 295 300  
 Cys Lys Arg Pro Gly Asn Lys Thr Val Leu Pro Ile Thr Leu Met Ser  
 305 310 315 320  
 Gly Leu Val Phe His Ser Gln Pro Ile Asn Thr Arg Pro Arg Gln Ala  
 325 330 335  
 Trp Cys Arg Phe Gly Gly Arg Trp Arg Glu Ala Met Gln Glu Val Lys  
 340 345 350  
 Gln Thr Leu Val Gln His Pro Arg Tyr Lys Gly Ile Asn Asp Thr Gly  
 355 360 365  
 Lys Ile Asn Phe Thr Lys Pro Gly Ala Gly Ser Asp Pro Glu Val Ala  
 370 375 380  
 Phe Met Trp Thr Asn Cys Arg Gly Glu Phe Leu Tyr Cys Asn Met Thr  
 385 390 395 400  
 Trp Phe Leu Asn Trp Val Glu Asp Lys Asn Gln Thr Arg Arg Asn Tyr  
 405 410 415  
 Cys His Ile Lys Gln Ile Ile Asn Thr Trp His Lys Val Gly Lys Asn  
 420 425 430  
 Val Tyr Leu Pro Pro Arg Glu Gly Glu Leu Ala Cys Glu Ser Thr Val  
 435 440 445  
 Thr Ser Ile Ile Ala Asn Ile Asp Ile Asp Lys Asn Arg Thr His Thr  
 450 455 460  
 Asn Ile Thr Phe Ser Ala Glu Val Ala Glu Leu Tyr Arg Leu Glu Leu  
 465 470 475 480  
 Gly Asp Tyr Lys Leu Ile Glu Ile Thr Pro Ile Gly Phe Ala Pro Thr  
 485 490 495  
 Asp Gln Arg Arg Tyr Ser Ser Thr Pro Val Arg Asn Lys Arg Gly Val  
 500 505 510  
 Phe Val Leu Gly Phe Leu Gly Phe Leu Ala Thr Ala Gly Ser Ala Met  
 515 520 525  
 Gly Ala Arg Ser Leu Thr Leu Ser Ala Gln Ser Arg Thr Leu Leu Ala  
 530 535 540  
 Gly Ile Val Gln Gln Gln Gln Leu Leu Asp Val Val Lys Arg Gln  
 545 550 555 560  
 Gln Glu Met Leu Arg Leu Thr Val Trp Gly Thr Lys Asn Leu Gln Ala  
 565 570 575  
 Arg Val Thr Ala Ile Glu Lys Tyr Leu Lys His Gln Ala Gln Leu Asn  
 580 585 590  
 Ser Trp Gly Cys Ala Phe Arg Gln Val Cys His Thr Thr Val Pro Trp  
 595 600 605  
 Val Asn Asp Ser Leu Ser Pro Asp Trp Lys Asn Met Thr Trp Gln Glu  
 610 615 620  
 Trp Glu Lys Gln Val Arg Tyr Leu Glu Ala Asn Ile Ser Gln Ser Leu  
 625 630 635 640  
 Glu Glu Ala Gln Ile Gln Gln Glu Lys Asn Met Tyr Glu Leu Gln Lys  
 645 650 655  
 Leu Asn Ser Trp Asp Ile Leu Gly Asn Trp Phe Asp Leu Thr Ser Trp  
 660 665 670  
 Val Lys Tyr Ile Gln Tyr Gly Val His Ile Val Val Gly Ile Ile Ala  
 675 680 685  
 Leu Arg Ile Ala Ile Tyr Val Val Gln Leu Leu Ser Arg Phe Arg Lys  
 690 695 700  
 Gly Tyr Arg Pro Val Phe Ser Ser Pro Pro Gly Tyr Leu Gln Gln Ile

705	710	715	720
His Ile His Lys Asp Arg Gly Gln Pro Ala Asn Glu Gly Thr Glu Glu			
725	730	735	
Asp Val Gly Gly Asp Ser Gly Tyr Asp Leu Trp Pro Trp Pro Ile Asn			
740	745	750	
Tyr Val Gln Phe Leu Ile His Leu Leu Thr Arg Leu Leu Ile Gly Leu			
755	760	765	
Tyr Asn Ile Cys Arg Asp Leu Leu Ser Lys Asn Ser Pro Thr Arg Arg			
770	775	780	
Leu Ile Ser Gln Ser Leu Thr Ala Ile Arg Asp Trp Leu Arg Leu Lys			
785	790	795	800
Ala Ala Gln Leu Gln Tyr Gly Cys Glu Trp Ile Gln Glu Ala Phe Gln			
805	810	815	
Ala Phe Ala Arg Thr Arg Glu Thr Leu Ala Gly Ala Trp Gly Trp			
820	825	830	
Leu Trp Glu Ala Ala Arg Arg Ile Gly Arg Gly Ile Leu Ala Val Pro			
835	840	845	
Arg Arg Ile Arg Gln Gly Ala Glu Leu Ala Leu Leu			
850	855	860	

&lt;210&gt; 218

&lt;211&gt; 25

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 218

Ser Glu Gly Asp Thr Asp Glu Leu Ala Lys Leu Val Glu Met Gly Asn			
1	5	10	15
Tyr Asp Leu Gly Asp Ala Ser Asp Leu			
20	25		

&lt;210&gt; 219

&lt;211&gt; 854

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 219

Met Arg Val Lys Gly Ile Met Arg Asn Cys Gln Gln Trp Trp Ile Trp			
1	5	10	15
Gly Ile Leu Gly Phe Trp Met Leu Leu Ile Cys Asn Gly Glu Gly Asn			
20	25	30	
Leu Trp Val Thr Val Tyr Gly Val Pro Val Trp Lys Glu Ala Lys			
35	40	45	
Thr Thr Leu Phe Cys Ala Ser Asp Ala Lys Gly Tyr Glu Arg Glu Val			
50	55	60	
His Asn Ile Trp Ala Thr His Ala Cys Val Pro Thr Asp Pro Asn Pro			
65	70	75	80
Gln Glu Met Phe Leu His Asn Val Thr Glu Asn Phe Asn Met Trp Lys			
85	90	95	
Asn Asp Met Val Asp Gln Met His Glu Asp Ile Ile Ser Leu Trp Asp			
100	105	110	
Glu Ser Leu Lys Pro Cys Val Lys Leu Thr Pro Leu Cys Val Thr Leu			
115	120	125	
Glu Cys Lys Asn Val Thr Thr Asn Val Thr Ile Asn Asn Ala Thr Ser			
130	135	140	
Val Thr Ala Asn Asn Asn Thr Ser Asp Met Lys Asn Cys Ser Phe Asn			
145	150	155	160
Ala Thr Thr Glu Val Thr Asp Lys Ile Arg Lys Glu Asn Ala Leu Phe			
165	170	175	

Tyr Thr Leu Asp Ile Val Pro Leu Asp Glu Asn Gln Asn Asn Ser Asn  
                  180                 185                 190  
 Tyr Arg Leu Ile Asn Cys Asn Thr Ser Lys Val Thr Gln Ala Cys Pro  
                  195                 200                 205  
 Lys Val Ser Phe Asp Pro Ile Pro Leu His Tyr Cys Ala Pro Ala Gly  
                  210                 215                 220  
 Tyr Ala Ile Leu Lys Cys Asn Asn Asn Thr Phe Asn Gly Thr Gly Pro  
                  225                 230                 235                 240  
 Cys Asn Asn Val Ser Thr Ile Gln Cys Thr His Gly Ile Lys Pro Val  
                  245                 250                 255  
 Val Ser Thr Gln Leu Leu Leu Asn Gly Ser Arg Ala Glu Lys Glu Ile  
                  260                 265                 270  
 Ile Ile Arg Ser Glu Asn Met Thr Asn Asn Ala Lys Thr Ile Ile Val  
                  275                 280                 285  
 His Leu Asn Glu Ser Ile Glu Ile Glu Cys Ile Arg Pro Asn Asn Asn  
                  290                 295                 300  
 Thr Arg Lys Ser Ile Arg Ile Gly Pro Gly Gln Thr Phe Tyr Ala Thr  
                  305                 310                 315                 320  
 Asn Gly Met Ile Gly Asp Ile Arg Gln Ala His Cys Asn Ile Ser Gly  
                  325                 330                 335  
 Ala Asp Trp Asn Arg Thr Leu Gln Gly Val Gly Arg Lys Leu Ala Gly  
                  340                 345                 350  
 Tyr Phe Pro Asn Lys Thr Ile Ser Phe Gln Pro Ser Ser Gly Gly Asp  
                  355                 360                 365  
 Leu Glu Ile Thr Thr His Ser Phe Asn Cys Gly Gly Glu Phe Phe Tyr  
                  370                 375                 380  
 Cys Asn Thr Ser Ser Leu Phe Asn Asn Thr Tyr Arg Pro Thr Tyr Trp  
                  385                 390                 395                 400  
 Pro Asn Gly Thr Glu Ser Asn Ser Thr Ile Thr Leu Gln Cys Arg Ile  
                  405                 410                 415  
 Lys Gln Ile Ile Asn Met Trp Gln Lys Val Gly Arg Ala Ile Tyr Ala  
                  420                 425                 430  
 Pro Pro Ile Ala Gly Lys Ile Thr Cys Lys Ser Asn Ile Thr Gly Leu  
                  435                 440                 445  
 Leu Leu Val Arg Asp Gly Gly Asn Gly Gly Asn Asn Thr Ala Thr Glu  
                  450                 455                 460  
 Ile Phe Arg Pro Gly Gly Asn Met Lys Asp Asn Trp Arg Ser Glu  
                  465                 470                 475                 480  
 Leu Tyr Lys Tyr Lys Val Val Glu Ile Lys Pro Leu Gly Ile Ala Pro  
                  485                 490                 495  
 Thr Gly Ala Lys Arg Arg Val Val Gly Arg Glu Lys Arg Ala Val Gly  
                  500                 505                 510  
 Ile Gly Ala Val Phe Leu Gly Phe Leu Gly Ala Ala Gly Ser Thr Met  
                  515                 520                 525  
 Gly Ala Ala Ser Ile Thr Leu Thr Val Gln Ala Arg Gln Leu Leu Ser  
                  530                 535                 540  
 Gly Ile Val Gln Gln Gln Ser Asn Leu Leu Lys Ala Ile Glu Ala Gln  
                  545                 550                 555                 560  
 His His Leu Leu Gln Leu Thr Val Trp Gly Ile Lys Gln Leu Gln Ala  
                  565                 570                 575  
 Arg Val Leu Ala Ile Glu Arg Tyr Leu Lys Asp Gln Gln Leu Leu Gly  
                  580                 585                 590  
 Ile Trp Gly Cys Ser Gly Lys Leu Ile Cys Thr Thr Ala Val Pro Trp  
                  595                 600                 605  
 Asn Ser Ser Trp Ser Asn Lys Ser Gln Ala Asp Ile Trp Asp Asn Met  
                  610                 615                 620  
 Thr Trp Met Gln Trp Asp Arg Glu Ile Ser Asn Tyr Thr Asp Thr Ile  
                  625                 630                 635                 640  
 Tyr Arg Leu Leu Glu Val Ser Gln Thr Gln Gln Glu Gln Asn Glu Gln  
                  645                 650                 655  
 Asp Leu Leu Ala Leu Asn Lys Trp Gln His Leu Trp Asn Trp Phe Asp

660	665	670
Ile Thr Lys Trp Leu Trp Tyr Ile Lys Ile Phe Ile Met Ile Val Gly		
675	680	685
Gly Leu Ile Gly Leu Arg Ile Ile Phe Ala Val Leu Ser Ile Val Asn		
690	695	700
Arg Val Arg Gln Gly Tyr Ser Pro Leu Ser Leu Gln Thr Leu Thr Pro		
705	710	715
Asn Gln Arg Glu Pro Asp Arg Leu Gly Arg Ile Glu Glu Glu Gly Gly		
725	730	735
Glu Gln Asp Arg Lys Arg Ser Ile Arg Leu Val Ser Gly Phe Leu Ala		
740	745	750
Leu Ala Trp Asp Asp Leu Arg Ser Leu Cys Leu Phe Ser Tyr His His		
755	760	765
Leu Arg Asp Phe Ile Leu Ile Ala Ala Arg Val Val Glu Leu Leu Gly		
770	775	780
Arg Arg Gly Trp Asp Ile Leu Lys Tyr Leu Ala Ser Leu Val Gln Tyr		
785	790	795
Trp Gly Leu Glu Leu Lys Lys Gly Ala Ile Ser Leu Leu Asp Ser Ile		
805	810	815
Ala Ile Ala Val Ala Glu Gly Thr Asp Arg Ile Ile Ala Phe Ile Gln		
820	825	830
Arg Leu Phe Arg Ala Ile Cys Asn Leu Pro Arg Arg Ile Arg Gln Gly		
835	840	845
Phe Glu Ala Ser Leu Leu		
850		

&lt;210&gt; 220

&lt;211&gt; 242

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 220

Met Ala Glu Thr Glu Ala Leu Ser Lys Leu Arg Glu Asp Phe Arg Met		
1	5	10
15		
Gln Asn Lys Ser Val Phe Ile Leu Gly Ala Ser Gly Glu Thr Gly Arg		
20	25	30
30		
Val Leu Leu Lys Glu Ile Leu Glu Gln Gly Leu Phe Ser Lys Val Thr		
35	40	45
45		
Leu Ile Gly Arg Arg Lys Leu Thr Phe Asp Glu Glu Ala Tyr Lys Asn		
50	55	60
60		
Val Asn Gln Glu Val Val Asp Phe Glu Lys Leu Asp Asp Tyr Ala Ser		
65	70	75
75		
80		
Ala Phe Gln Gly His Asp Val Gly Phe Cys Cys Leu Gly Thr Thr Arg		
85	90	95
95		
Gly Lys Ala Gly Ala Glu Gly Phe Val Arg Val Asp Arg Asp Tyr Val		
100	105	110
110		
Leu Lys Ser Ala Glu Leu Ala Lys Ala Gly Gly Cys Lys His Phe Asn		
115	120	125
125		
Leu Leu Ser Ser Lys Gly Ala Asp Lys Ser Ser Asn Phe Leu Tyr Leu		
130	135	140
140		
Gln Val Lys Gly Glu Val Glu Ala Lys Val Glu Glu Leu Lys Phe Asp		
145	150	155
155		
160		
Arg Tyr Ser Val Phe Arg Pro Gly Val Leu Leu Cys Asp Arg Gln Glu		
165	170	175
175		
Ser Arg Pro Gly Glu Trp Leu Val Arg Lys Phe Phe Gly Ser Leu Pro		
180	185	190
190		
Asp Ser Trp Ala Arg Gly His Ser Val Pro Val Val Thr Val Val Arg		
195	200	205
205		
Ala Met Leu Asn Asn Val Val Arg Pro Arg Asp Lys Gln Met Glu Leu		
210	215	220

Leu Glu Asn Lys Ala Ile His Asp Leu Gly Lys Ala His Gly Ser Leu  
 225 230 235 240  
 Lys Pro

<210> 221  
<211> 210  
<212> PRT  
<213> Human Immunodeficiency Virus

<220>  
<221> VARIANT  
<222> 31, 97, 140, 141, 144, 178  
<223> Xaa = Any Amino Acid

<400> 221  
Cys Thr Glu Met Glu Lys Glu Gly Lys Ile Ser Lys Ile Gly Pro Glu  
 1 5 10 15  
Asn Pro Tyr Asn Thr Pro Val Phe Ala Ile Lys Lys Lys Asp Xaa Thr  
 20 25 30  
Lys Trp Arg Lys Leu Val Asp Phe Arg Glu Leu Asn Lys Arg Thr Gln  
 35 40 45  
Asp Phe Trp Glu Val Gln Leu Gly Ile Pro His Pro Ala Gly Leu Lys  
 50 55 60  
Lys Lys Lys Ser Val Thr Val Leu Asp Val Gly Asp Ala Tyr Phe Ser  
 65 70 75 80  
Val Pro Leu Asp Glu Ser Phe Arg Lys Tyr Thr Ala Phe Thr Ile Pro  
 85 90 95  
Xaa Thr Asn Asn Glu Thr Pro Gly Ile Arg Tyr Gln Tyr Asn Val Leu  
 100 105 110  
Pro Gln Gly Trp Lys Gly Ser Pro Ala Ile Phe Gln Ser Ser Met Thr  
 115 120 125  
Lys Ile Leu Glu Pro Phe Arg Ile Lys Asn Pro Xaa Xaa Val Ile Xaa  
 130 135 140  
Gln Tyr Met Asp Asp Leu Tyr Val Gly Ser Asp Leu Glu Ile Gly Gln  
 145 150 155 160  
His Arg Ala Lys Ile Glu Glu Leu Arg Lys His Leu Leu Ser Trp Gly  
 165 170 175  
Phe Xaa Thr Pro Asp Lys Lys His Gln Lys Glu Pro Pro Phe Leu Trp  
 180 185 190  
Met Gly Tyr Glu Leu His Pro Asp Lys Trp Thr Val Gln Pro Ile Gln  
 195 200 205  
Leu Pro  
 210

<210> 222  
<211> 207  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 222  
Met Gly Gly Lys Trp Ser Lys Ser Ser Leu Val Gly Trp Pro Glu Val  
 1 5 10 15  
Arg Asp Arg Ile Arg Arg Thr Asp Pro Ala Ala Glu Gly Val Gly Ala  
 20 25 30  
Ala Ser Gln Asp Leu Asp Lys His Gly Ala Leu Thr Asn Ser Asn Thr  
 35 40 45  
Ala Ala Thr Asn Lys Asp Cys Ala Trp Leu Glu Ala Gln Glu Glu Glu  
 50 55 60

Gly Glu Val Gly Phe Pro Val Arg Pro Gln Val Pro Leu Arg Pro Met  
 65 70 75 80  
 Thr Tyr Lys Gly Ala Phe Asp Leu Gly Trp Phe Leu Lys Glu Lys Gly  
 85 90 95  
 Gly Leu Asp Gly Leu Ile Tyr Ser Lys Lys Arg Gln Glu Ile Leu Asp  
 100 105 110  
 Leu Trp Val Tyr His Thr Gln Gly Tyr Phe Pro Asp Trp Gln Asn Tyr  
 115 120 125  
 Thr Pro Gly Pro Gly Val Arg Tyr Pro Leu Thr Phe Gly Trp Cys Tyr  
 130 135 140  
 Lys Leu Val Pro Val Asp Pro Lys Glu Val Glu Glu Ala Thr Glu Gly  
 145 150 155 160  
 Glu Asn Asn Cys Leu Leu His Pro Ile Cys Gln His Gly Met Glu Asp  
 165 170 175  
 Glu Asp Arg Glu Val Leu Arg Trp Lys Phe Asp Ser Glu Leu Ala Arg  
 180 185 190  
 Arg His Ile Ala Arg Glu Arg His Pro Glu Phe Tyr Lys Asp Cys  
 195 200 205

&lt;210&gt; 223

&lt;211&gt; 397

&lt;212&gt; PRT

&lt;213&gt; Plasmodium falciparum

&lt;400&gt; 223

Met Met Arg Lys Leu Ala Ile Leu Ser Val Ser Ser Phe Leu Phe Val  
 1 5 10 15  
 Glu Ala Leu Phe Gln Glu Tyr Gln Cys Tyr Gly Ser Ser Ser Asn Thr  
 20 25 30  
 Arg Val Leu Asn Glu Leu Asn Tyr Asp Asn Ala Gly Thr Asn Leu Tyr  
 35 40 45  
 Asn Glu Leu Glu Met Asn Tyr Tyr Gly Lys Gln Glu Asn Trp Tyr Ser  
 50 55 60  
 Leu Lys Lys Asn Ser Arg Ser Leu Gly Glu Asn Asp Asp Gly Asn Asn  
 65 70 75 80  
 Glu Asp Asn Glu Lys Leu Arg Lys Pro Lys His Lys Lys Leu Lys Gln  
 85 90 95  
 Pro Ala Asp Gly Asn Pro Asp Pro Asn Ala Asn Pro Asn Val Asp Pro  
 100 105 110  
 Asn Ala Asn Pro Asn Val Asp Pro Asn Ala Asn Pro Asn Val Asp Pro  
 115 120 125  
 Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro  
 130 135 140  
 Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro  
 145 150 155 160  
 Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro  
 165 170 175  
 Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro  
 180 185 190  
 Asn Ala Asn Pro Asn Val Asp Pro Asn Ala Asn Pro Asn Ala Asn Pro  
 195 200 205  
 Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro  
 210 215 220  
 Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro  
 225 230 235 240  
 Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro  
 245 250 255  
 Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro  
 260 265 270  
 Asn Lys Asn Asn Gln Gly Asn Gly Gln Gly His Asn Met Pro Asn Asp

275	280	285
Pro Asn Arg Asn Val Asp Glu Asn Ala Asn Ala Asn Ser Ala Val Lys		
290	295	300
Asn Asn Asn Asn Glu Glu Pro Ser Asp Lys His Ile Lys Glu Tyr Leu		
305	310	315
Asn Lys Ile Gln Asn Ser Leu Ser Thr Glu Trp Ser Pro Cys Ser Val		
325	330	335
Thr Cys Gly Asn Gly Ile Gln Val Arg Ile Lys Pro Gly Ser Ala Asn		
340	345	350
Lys Pro Lys Asp Glu Leu Asp Tyr Ala Asn Asp Ile Glu Lys Lys Ile		
355	360	365
Cys Lys Met Glu Lys Cys Ser Ser Val Phe Asn Val Val Asn Ser Ser		
370	375	380
Ile Gly Leu Ile Met Val Leu Ser Phe Leu Phe Leu Asn		
385	390	395

&lt;210&gt; 224

&lt;211&gt; 69

&lt;212&gt; PRT

&lt;213&gt; Plasmodium falciparum

&lt;400&gt; 224

Thr Glu Trp Ser Pro Cys Ser Val Thr Cys Gly Asn Gly Ile Gln Val			
1	5	10	15
Arg Ile Lys Pro Gly Ser Ala Asn Lys Pro Lys Asp Glu Leu Asp Tyr			
20	25	30	
Glu Asn Asp Ile Glu Lys Lys Ile Cys Lys Met Glu Lys Cys Ser Ser			
35	40	45	
Val Phe Asn Val Val Asn Ser Ser Ile Gly Leu Ile Met Val Leu Ser			
50	55	60	
Phe Leu Phe Leu Asn			
65			

&lt;210&gt; 225

&lt;211&gt; 137

&lt;212&gt; PRT

&lt;213&gt; Salmonella enterica

&lt;400&gt; 225

Met Tyr Met Ser Lys Tyr Val Pro Val Tyr Thr Leu Leu Ile Leu Ile			
1	5	10	15
Tyr Ser Phe Asn Ala Ser Ala Glu Trp Thr Gly Asp Asn Thr Asn Ala			
20	25	30	
Tyr Tyr Ser Asp Glu Val Ile Ser Glu Leu His Val Gly Gln Ile Asp			
35	40	45	
Thr Ser Pro Tyr Phe Cys Ile Lys Thr Val Lys Ala Asn Gly Ser Gly			
50	55	60	
Thr Pro Val Val Ala Cys Ala Val Ser Lys Gln Ser Ile Trp Ala Pro			
65	70	75	80
Ser Phe Lys Glu Leu Leu Asp Gln Ala Arg Tyr Phe Tyr Ser Thr Gly			
85	90	95	
Gln Ser Val Arg Ile His Val Gln Lys Asn Ile Trp Thr Tyr Pro Leu			
100	105	110	
Phe Val Asn Thr Phe Ser Ala Asn Ala Leu Val Gly Leu Ser Ser Cys			
115	120	125	
Ser Ala Thr Gln Cys Phe Gly Pro Lys			
130	135		

<210> 226  
<211> 233  
<212> PRT  
<213> Staphylococcus aureus

<400> 226

Ser	Glu	Lys	Ser	Glu	Glu	Ile	Asn	Glu	Lys	Asp	Leu	Arg	Lys	Lys	Ser
1				5					10						15
Glu	Leu	Gln	Gly	Thr	Ala	Leu	Gly	Asn	Leu	Lys	Gln	Ile	Tyr	Tyr	Tyr
				20					25						30
Asn	Glu	Lys	Ala	Lys	Thr	Glu	Asn	Lys	Glu	Ser	His	Asp	Gln	Phe	Leu
	35						40							45	
Gln	His	Thr	Ile	Leu	Phe	Lys	Gly	Phe	Phe	Thr	Asp	His	Ser	Trp	Tyr
	50					55				60					
Asn	Asp	Leu	Leu	Val	Asp	Phe	Asp	Ser	Lys	Asp	Ile	Val	Asp	Lys	Tyr
	65					70				75					80
Lys	Gly	Lys	Lys	Val	Asp	Leu	Tyr	Gly	Ala	Tyr	Tyr	Gly	Tyr	Gln	Cys
						85			90						95
Ala	Gly	Gly	Thr	Pro	Asn	Lys	Thr	Ala	Cys	Met	Tyr	Gly	Gly	Val	Thr
							100		105						110
Leu	His	Asp	Asn	Asn	Arg	Leu	Thr	Glu	Glu	Lys	Lys	Val	Pro	Ile	Asn
		115						120						125	
Leu	Trp	Leu	Asp	Gly	Lys	Gln	Asn	Thr	Val	Pro	Leu	Glu	Thr	Val	Lys
		130						135						140	
Thr	Asn	Lys	Lys	Asn	Val	Thr	Val	Gln	Glu	Leu	Asp	Leu	Gln	Ala	Arg
	145							150							160
Arg	Tyr	Leu	Gln	Glu	Lys	Tyr	Asn	Leu	Tyr	Asn	Ser	Asp	Val	Phe	Asp
						165			170						175
Gly	Lys	Val	Gln	Arg	Gly	Leu	Ile	Val	Phe	His	Thr	Ser	Thr	Glu	Pro
						180			185						190
Ser	Val	Asn	Tyr	Asp	Leu	Phe	Gly	Ala	Gln	Gly	Gln	Tyr	Ser	Asn	Thr
			195					200							205
Leu	Leu	Arg	Ile	Tyr	Arg	Asp	Asn	Lys	Ser	Ile	Asn	Ser	Glu	Asn	Met
	210					215								220	
His	Ile	Asp	Ile	Tyr	Leu	Tyr	Thr	Ser							
	225					230									

<210> 227  
<211> 68  
<212> PRT  
<213> Escherichia coli

<400> 227

Ala	Trp	Arg	Glu	Glu	Pro	Trp	Ile	His	His	Ala	Pro	Gln	Gly	Cys	Gly
1				5				10						15	
Asp	Ser	Ser	Arg	Thr	Ile	Thr	Gly	Asp	Thr	Cys	Asn	Glu	Glu	Thr	Gln
				20				25						30	
Asn	Leu	Ser	Thr	Ile	Tyr	Leu	Arg	Lys	Tyr	Gln	Ser	Lys	Val	Lys	Arg
				35				40						45	
Gln	Ile	Phe	Ser	Asp	Tyr	Gln	Ser	Glu	Val	Asp	Ile	Tyr	Asn	Arg	Ile
		50				55							60		
Arg	Asn	Glu	Leu												
	65														

<210> 228  
<211> 396  
<212> PRT  
<213> Clostridium difficile

<400> 228

Asn	Glu	Tyr	Tyr	Pro	Glu	Ile	Ile	Val	Leu	Asn	Pro	Asn	Thr	Phe	His
1				5				10						15	
Lys	Lys	Val	Asn	Ile	Asn	Leu	Asp	Ser	Ser	Ser	Phe	Glu	Tyr	Lys	Trp
				20				25						30	
Ser	Thr	Glu	Gly	Ser	Asp	Phe	Ile	Leu	Val	Arg	Tyr	Leu	Glu	Glu	Ser
				35				40					45		
Asn	Lys	Lys	Ile	Leu	Gln	Lys	Ile	Arg	Ile	Lys	Gly	Ile	Leu	Ser	Asn
				50				55				60			
Thr	Lys	Ser	Phe	Asn	Lys	Met	Ser	Ile	Asp	Phe	Lys	Asp	Ile	Lys	Lys
				65				70			75			80	
Leu	Ser	Leu	Gly	Tyr	Ile	Met	Ser	Asn	Phe	Lys	Ser	Phe	Asn	Ser	Glu
				85				90					95		
Asn	Glu	Leu	Asp	Arg	Asp	His	Leu	Gly	Phe	Lys	Ile	Ile	Asp	Asn	Lys
				100				105					110		
Thr	Tyr	Tyr	Tyr	Asp	Glu	Ala	Ser	Lys	Leu	Val	Lys	Gly	Leu	Ile	Asn
				115				120					125		
Ile	Asn	Asn	Ser	Leu	Phe	Tyr	Phe	Asp	Pro	Ile	Glu	Ser	Asn	Leu	Val
				130				135				140			
Thr	Gly	Trp	Gln	Thr	Ile	Asn	Gly	Lys	Lys	Tyr	Tyr	Phe	Asp	Ile	Asn
				145				150			155			160	
Thr	Gly	Ala	Ala	Ser	Thr	Ser	Tyr	Lys	Ile	Ile	Asn	Gly	Lys	His	Phe
				165				170					175		
Tyr	Phe	Asn	Asn	Gly	Val	Met	Gln	Leu	Gly	Val	Phe	Lys	Gly	Pro	
				180				185				190			
Asp	Gly	Phe	Glu	Tyr	Phe	Ala	Pro	Ala	Asn	Thr	Gln	Asn	Asn	Asn	Ile
				195				200				205			
Glu	Gly	Gln	Ala	Ile	Val	Tyr	Gln	Ser	Lys	Phe	Leu	Thr	Leu	Asn	Gly
				210				215				220			
Lys	Lys	Tyr	Tyr	Phe	Asp	Asn	Ser	Lys	Ala	Val	Thr	Gly	Trp	Gln	
				225				230			235			240	
Thr	Ile	Asp	Gly	Lys	Lys	Tyr	Tyr	Phe	Asn	Leu	Asn	Thr	Ala	Glu	Ala
				245				250					255		
Ala	Thr	Gly	Trp	Gln	Thr	Ile	Asp	Gly	Lys	Lys	Tyr	Tyr	Phe	Asn	Thr
				260				265				270			
Asn	Thr	Ser	Ile	Ala	Ser	Thr	Gly	Tyr	Thr	Ile	Asn	Gly	Lys	His	
				275				280				285			
Phe	Tyr	Phe	Asn	Thr	Asp	Gly	Ile	Met	Gln	Ile	Gly	Val	Phe	Lys	Gly
				290				295				300			
Pro	Asn	Gly	Phe	Glu	Tyr	Phe	Ala	Pro	Ala	Asn	Thr	Asp	Ala	Asn	Asn
				305				310			315			320	
Ile	Glu	Gly	Gln	Ala	Ile	Arg	Tyr	Gln	Asn	Arg	Phe	Leu	Tyr	Leu	His
				325				330					335		
Asp	Asn	Ile	Tyr	Tyr	Phe	Gly	Asn	Asn	Ser	Lys	Ala	Val	Thr	Gly	Trp
				340				345					350		
Gln	Thr	Ile	Asn	Gly	Asn	Val	Tyr	Tyr	Phe	Met	Pro	Asp	Thr	Ala	Met
				355				360				365			
Ala	Ala	Ala	Gly	Gly	Leu	Phe	Glu	Ile	Asp	Gly	Val	Ile	Tyr	Phe	Phe
				370				375				380			
Gly	Val	Asp	Gly	Val	Lys	Ala	Pro	Gly	Ile	Tyr	Gly				
				385				390				395			

&lt;210&gt; 229

&lt;211&gt; 386

&lt;212&gt; PRT

&lt;213&gt; Bacillus cereus

&lt;400&gt; 229

Met	Lys	Lys	Thr	Leu	Ile	Thr	Gly	Leu	Leu	Val	Thr	Ala	Val	Ser	Thr
1				5				10					15		

Ser Arg Phe Ile Pro Val Ser Ala Tyr Ala Lys Glu Gly Gln Thr Glu  
     20                       25                       30  
 Val Lys Thr Val Tyr Ala Gln Asn Val Ile Ala Pro Asn Thr Leu Ser  
     35                       40                       45  
 Asn Ser Ile Arg Met Leu Gly Ser Gln Ser Pro Leu Ile Gln Ala Tyr  
     50                       55                       60  
 Gly Leu Ile Ile Leu Gln Gln Pro Asp Ile Lys Val Asn Ala Met Ser  
     65                       70                       75                       80  
 Ser Leu Thr Asn His Gln Lys Phe Ala Lys Ala Asn Val Arg Glu Trp  
     85                       90                       95  
 Ile Asp Glu Tyr Asn Pro Lys Leu Ile Asp Leu Asn Gln Glu Met Met  
     100                       105                       110  
 Arg Tyr Ser Thr Arg Phe Asn Ser Tyr Tyr Ser Lys Leu Tyr Glu Leu  
     115                       120                       125  
 Ala Gly Asn Val Asn Glu Asp Gln Gln Ala Lys Ala Asp Phe Met Ser  
     130                       135                       140  
 Ala Tyr Gly Lys Leu Gln Leu Gln Val Gln Ser Ile Gln Glu Ser Met  
     145                       150                       155                       160  
 Glu Gln Asp Leu Leu Glu Leu Asn Arg Phe Lys Thr Val Leu Asp Lys  
     165                       170                       175  
 Asp Ser Asn Asn Leu Ser Ile Lys Ala Asp Glu Ala Ile Lys Thr Leu  
     180                       185                       190  
 Gln Gly Ser Ser Gly Asp Ile Val Lys Leu Arg Glu Asp Ile Lys Arg  
     195                       200                       205  
 Ile Gln Gly Glu Ile Gln Ala Glu Leu Thr Thr Ile Leu Asn Arg Pro  
     210                       215                       220  
 Gln Glu Ile Ile Lys Gly Ser Ile Asn Ile Gly Lys Gln Val Phe Thr  
     225                       230                       235                       240  
 Ile Thr Asn Gln Thr Ala Gln Thr Lys Thr Ile Asp Phe Val Ser Ile  
     245                       250                       255  
 Gly Thr Leu Ser Asn Glu Ile Val Asn Ala Ala Asp Ser Gln Thr Arg  
     260                       265                       270  
 Glu Ala Ala Leu Arg Ile Gln Gln Lys Gln Lys Glu Leu Leu Pro Leu  
     275                       280                       285  
 Ile Gln Lys Leu Ser Gln Thr Glu Ala Glu Ala Thr Gln Ile Thr Phe  
     290                       295                       300  
 Val Glu Asp Gln Val Asn Ser Phe Thr Glu Leu Ile Asp Arg Gln Ile  
     305                       310                       315                       320  
 Thr Thr Leu Glu Thr Leu Leu Thr Asp Trp Lys Val Leu Asn Asn Asn  
     325                       330                       335  
 Met Ile Gln Ile Gln Lys Asn Val Glu Glu Gly Thr Tyr Thr Asp Ser  
     340                       345                       350  
 Ser Leu Leu Gln Lys His Phe Asn Gln Ile Lys Lys Val Ser Asp Glu  
     355                       360                       365  
 Met Asn Lys Gln Thr Asn Gln Phe Glu Asp Tyr Val Thr Asn Val Glu  
     370                       375                       380  
 Val His  
     385

<210> 230  
 <211> 227  
 <212> PRT  
 <213> Bordetella pertussis

<400> 230  
 Met Leu Ile Asn Asn Lys Lys Leu Leu His His Ile Leu Pro Ile Leu  
     1                       5                       10                       15  
 Val Leu Ala Leu Leu Gly Met Arg Thr Ala Gln Ala Val Ala Pro Gly  
     20                       25                       30  
 Ile Val Ile Pro Pro Lys Ala Leu Phe Thr Gln Gln Gly Gly Ala Tyr

35	40	45
Gly Arg Cys Pro Asn Gly Thr Arg Ala Leu Thr Val Ala Glu Leu Arg		
50	55	60
Gly Asn Ala Glu Leu Gln Thr Tyr Leu Arg Gln Ile Thr Pro Gly Trp		
65	70	75
Ser Ile Tyr Gly Leu Tyr Asp Gly Thr Tyr Leu Gly Gln Ala Tyr Gly		80
85	90	95
Gly Ile Ile Lys Asp Ala Pro Pro Gly Ala Gly Phe Ile Tyr Arg Glu		
100	105	110
Thr Phe Cys Ile Thr Thr Ile Tyr Lys Thr Gly Gln Pro Ala Ala Asp		
115	120	125
His Tyr Tyr Ser Lys Val Thr Ala Thr Arg Leu Leu Ala Ser Thr Asn		
130	135	140
Ser Arg Leu Cys Ala Val Phe Val Arg Asp Gly Gln Ser Val Ile Gly		
145	150	155
Ala Cys Ala Ser Pro Tyr Glu Gly Arg Tyr Arg Asp Met Tyr Asp Ala		160
165	170	175
Leu Arg Arg Leu Leu Tyr Met Ile Tyr Met Ser Gly Leu Ala Val Arg		
180	185	190
Val His Val Ser Lys Glu Glu Gln Tyr Tyr Asp Tyr Glu Asp Ala Thr		
195	200	205
Phe Gln Thr Tyr Ala Leu Thr Gly Ile Ser Leu Cys Asn Pro Ala Ala		
210	215	220
Ser Ile Cys		
225		

&lt;210&gt; 231

&lt;211&gt; 76

&lt;212&gt; PRT

&lt;213&gt; SARS coronavirus

&lt;400&gt; 231

Met Tyr Ser Phe Val Ser Glu Glu Thr Gly Thr Leu Ile Val Asn Ser		
1	5	10
Val Leu Leu Phe Leu Ala Phe Val Val Phe Leu Leu Val Thr Leu Ala		15
20	25	30
Ile Leu Thr Ala Leu Arg Leu Cys Ala Tyr Cys Cys Asn Ile Val Asn		
35	40	45
Val Ser Leu Val Lys Pro Thr Val Tyr Val Tyr Ser Arg Val Lys Asn		
50	55	60
Leu Asn Ser Ser Glu Gly Val Pro Asp Leu Leu Val		
65	70	75

&lt;210&gt; 232

&lt;211&gt; 125

&lt;212&gt; PRT

&lt;213&gt; Homo sapiens

&lt;400&gt; 232

Gln Ile Lys Leu Met Leu Glu Asn Arg Ala Met Val Arg Arg Lys Gly		
1	5	10
Phe Gly Ile Leu Ile Gly Val Tyr Gly Ser Ser Val Ile Tyr Met Val		15
20	25	30
Gln Leu Pro Ile Phe Gly Val Ile Asp Thr Pro Cys Trp Ile Ile Lys		
35	40	45
Ala Ala Pro Ser Cys Ser Glu Lys Asp Gly Asn Tyr Ala Cys Leu Leu		
50	55	60
Arg Glu Asp Gln Gly Trp Tyr Cys Lys Asn Ala Gly Ser Thr Val Tyr		

65	70	75	80
Tyr Pro Asn Glu Lys Asp Cys Glu Thr Arg Gly Asp His Val Phe Cys			
85	90	95	
Asp Thr Ala Ala Gly Ile Asn Val Ala Glu Gln Ser Arg Glu Cys Asn			
100	105	110	
Ile Asn Ile Ser Thr Thr Asn Tyr Pro Cys Lys Val Ser			
115	120	125	

<210> 233  
<211> 221  
<212> PRT  
<213> SARS coronavirus

<400> 233			
Met Ala Asp Asn Gly Thr Ile Thr Val Glu Glu Leu Lys Gln Leu Leu			
1	5	10	15
Glu Gln Trp Asn Leu Val Ile Gly Phe Leu Phe Leu Ala Trp Ile Met			
20	25	30	
Leu Leu Gln Phe Ala Tyr Ser Asn Arg Asn Arg Phe Leu Tyr Ile Ile			
35	40	45	
Lys Leu Val Phe Leu Trp Leu Leu Trp Pro Val Thr Leu Ala Cys Phe			
50	55	60	
Val Leu Ala Ala Val Tyr Arg Ile Asn Trp Val Thr Gly Gly Ile Ala			
65	70	75	80
Ile Ala Met Ala Cys Ile Val Gly Leu Met Trp Leu Ser Tyr Phe Val			
85	90	95	
Ala Ser Phe Arg Leu Phe Ala Arg Thr Arg Ser Met Trp Ser Phe Asn			
100	105	110	
Pro Glu Thr Asn Ile Leu Leu Asn Val Pro Leu Arg Gly Thr Ile Val			
115	120	125	
Thr Arg Pro Leu Met Glu Ser Glu Leu Val Ile Gly Ala Val Ile Ile			
130	135	140	
Arg Gly His Leu Arg Met Ala Gly His Ser Leu Gly Arg Cys Asp Ile			
145	150	155	160
Lys Asp Leu Pro Lys Glu Ile Thr Val Ala Thr Ser Arg Thr Leu Ser			
165	170	175	
Tyr Tyr Lys Leu Gly Ala Ser Gln Arg Val Gly Thr Asp Ser Gly Phe			
180	185	190	
Ala Ala Tyr Asn Arg Tyr Arg Ile Gly Asn Tyr Lys Leu Asn Thr Asp			
195	200	205	
His Ala Gly Ser Asn Asp Asn Ile Ala Leu Leu Val Gln			
210	215	220	

<210> 234  
<211> 422  
<212> PRT  
<213> SARS coronavirus

<400> 234			
Met Ser Asp Asn Gly Pro Gln Ser Asn Gln Arg Ser Ala Pro Arg Ile			
1	5	10	15
Thr Phe Gly Gly Pro Thr Asp Ser Thr Asp Asn Asn Gln Asn Gly Gly			
20	25	30	
Arg Asn Gly Ala Arg Pro Lys Gln Arg Arg Pro Gln Gly Leu Pro Asn			
35	40	45	
Asn Thr Ala Ser Trp Phe Thr Ala Leu Thr Gln His Gly Lys Glu Glu			
50	55	60	
Leu Arg Phe Pro Arg Gly Gln Gly Val Pro Ile Asn Thr Asn Ser Gly			
65	70	75	80

Pro Asp Asp Gln Ile Gly Tyr Tyr Arg Arg Ala Thr Arg Arg Val Arg  
                   85                 90                 95  
 Gly Gly Asp Gly Lys Met Lys Glu Leu Ser Pro Arg Trp Tyr Phe Tyr  
                   100             105             110  
 Tyr Leu Gly Thr Gly Pro Glu Ala Ser Leu Pro Tyr Gly Ala Asn Lys  
                   115             120             125

Glu Gly Ile Val Trp Val Ala Thr Glu Gly Ala Leu Asn Thr Pro Lys  
                   130             135             140  
 Asp His Ile Gly Thr Arg Asn Pro Asn Asn Ala Ala Thr Val Leu  
                   145             150             155             160  
 Gln Leu Pro Gln Gly Thr Thr Leu Pro Lys Gly Phe Tyr Ala Glu Gly  
                   165             170             175  
 Ser Arg Gly Gly Ser Gln Ala Ser Ser Arg Ser Ser Arg Ser Arg  
                   180             185             190  
 Gly Asn Ser Arg Asn Ser Thr Pro Gly Ser Ser Arg Gly Asn Ser Pro  
                   195             200             205  
 Ala Arg Met Ala Ser Gly Gly Glu Thr Ala Leu Ala Leu Leu Leu  
                   210             215             220  
 Leu Asp Arg Leu Asn Gln Leu Glu Ser Lys Val Ser Gly Lys Gly Gln  
                   225             230             235             240  
 Gln Gln Gln Gly Gln Thr Val Thr Lys Lys Ser Ala Ala Glu Ala Ser  
                   245             250             255  
 Lys Lys Pro Arg Gln Lys Arg Thr Ala Thr Lys Gln Tyr Asn Val Thr  
                   260             265             270  
 Gln Ala Phe Gly Arg Arg Gly Pro Glu Gln Thr Gln Gly Asn Phe Gly  
                   275             280             285  
 Asp Gln Asp Leu Ile Arg Gln Gly Thr Asp Tyr Lys His Trp Pro Gln  
                   290             295             300  
 Ile Ala Gln Phe Ala Pro Ser Ala Ser Ala Phe Phe Gly Met Ser Arg  
                   305             310             315             320  
 Ile Gly Met Glu Val Thr Pro Ser Gly Thr Trp Leu Thr Tyr His Gly  
                   325             330             335  
 Ala Ile Lys Leu Asp Asp Lys Asp Pro Gln Phe Lys Asp Asn Val Ile  
                   340             345             350  
 Leu Leu Asn Lys His Ile Asp Ala Tyr Lys Thr Phe Pro Pro Thr Glu  
                   355             360             365  
 Pro Lys Lys Asp Lys Lys Lys Thr Asp Glu Ala Gln Pro Leu Pro  
                   370             375             380  
 Gln Arg Gln Lys Lys Gln Pro Thr Val Thr Leu Leu Pro Ala Ala Asp  
                   385             390             395             400  
 Met Asp Asp Phe Ser Arg Gln Leu Gln Asn Ser Met Ser Gly Ala Ser  
                   405             410             415  
 Ala Asp Ser Thr Gln Ala  
                   420

&lt;210&gt; 235

&lt;211&gt; 1255

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 235

Met Phe Ile Phe Leu Leu Phe Leu Thr Leu Thr Ser Gly Ser Asp Leu  
   1                 5                 10                 15  
 Asp Arg Cys Thr Thr Phe Asp Asp Val Gln Ala Pro Asn Tyr Thr Gln  
   20             25             30  
 His Thr Ser Ser Met Arg Gly Val Tyr Tyr Pro Asp Glu Ile Phe Arg  
   35             40             45  
 Ser Asp Thr Leu Tyr Leu Thr Gln Asp Leu Phe Leu Pro Phe Tyr Ser  
   50             55             60

Asn Val Thr Gly Phe His Thr Ile Asn His Thr Phe Gly Asn Pro Val  
 65 70 75 80  
 Ile Pro Phe Lys Asp Gly Ile Tyr Phe Ala Ala Thr Glu Lys Ser Asn  
 85 90 95  
 Val Val Arg Gly Trp Val Phe Gly Ser Thr Met Asn Asn Lys Ser Gln  
 100 105 110  
 Ser Val Ile Ile Asn Asn Ser Thr Asn Val Val Ile Arg Ala Cys  
 115 120 125  
 Asn Phe Glu Leu Cys Asp Asn Pro Phe Phe Ala Val Ser Lys Pro Met  
 130 135 140  
 Gly Thr Gln Thr His Thr Met Ile Phe Asp Asn Ala Phe Asn Cys Thr  
 145 150 155 160  
 Phe Glu Tyr Ile Ser Asp Ala Phe Ser Leu Asp Val Ser Glu Lys Ser  
 165 170 175  
 Gly Asn Phe Lys His Leu Arg Glu Phe Val Phe Lys Asn Lys Asp Gly  
 180 185 190  
 Phe Leu Tyr Val Tyr Lys Gly Tyr Gln Pro Ile Asp Val Val Arg Asp  
 195 200 205  
 Leu Pro Ser Gly Phe Asn Thr Leu Lys Pro Ile Phe Lys Leu Pro Leu  
 210 215 220  
 Gly Ile Asn Ile Thr Asn Phe Arg Ala Ile Leu Thr Ala Phe Ser Pro  
 225 230 235 240  
 Ala Gln Asp Ile Trp Gly Thr Ser Ala Ala Ala Tyr Phe Val Gly Tyr  
 245 250 255  
 Leu Lys Pro Thr Thr Phe Met Leu Lys Tyr Asp Glu Asn Gly Thr Ile  
 260 265 270  
 Thr Asp Ala Val Asp Cys Ser Gln Asn Pro Leu Ala Glu Leu Lys Cys  
 275 280 285  
 Ser Val Lys Ser Phe Glu Ile Asp Lys Gly Ile Tyr Gln Thr Ser Asn  
 290 295 300  
 Phe Arg Val Val Pro Ser Gly Asp Val Val Arg Phe Pro Asn Ile Thr  
 305 310 315 320  
 Asn Leu Cys Pro Phe Gly Glu Val Phe Asn Ala Thr Lys Phe Pro Ser  
 325 330 335  
 Val Tyr Ala Trp Glu Arg Lys Lys Ile Ser Asn Cys Val Ala Asp Tyr  
 340 345 350  
 Ser Val Leu Tyr Asn Ser Thr Phe Phe Ser Thr Phe Lys Cys Tyr Gly  
 355 360 365  
 Val Ser Ala Thr Lys Leu Asn Asp Leu Cys Phe Ser Asn Val Tyr Ala  
 370 375 380  
 Asp Ser Phe Val Val Lys Gly Asp Asp Val Arg Gln Ile Ala Pro Gly  
 385 390 395 400  
 Gln Thr Gly Val Ile Ala Asp Tyr Asn Tyr Lys Leu Pro Asp Asp Phe  
 405 410 415  
 Met Gly Cys Val Leu Ala Trp Asn Thr Arg Asn Ile Asp Ala Thr Ser  
 420 425 430  
 Thr Gly Asn Tyr Asn Tyr Lys Tyr Arg Tyr Leu Arg His Gly Lys Leu  
 435 440 445  
 Arg Pro Phe Glu Arg Asp Ile Ser Asn Val Pro Phe Ser Pro Asp Gly  
 450 455 460  
 Lys Pro Cys Thr Pro Pro Ala Leu Asn Cys Tyr Trp Pro Leu Asn Asp  
 465 470 475 480  
 Tyr Gly Phe Tyr Thr Thr Gly Ile Gly Tyr Gln Pro Tyr Arg Val  
 485 490 495  
 Val Val Leu Ser Phe Glu Leu Leu Asn Ala Pro Ala Thr Val Cys Gly  
 500 505 510  
 Pro Lys Leu Ser Thr Asp Leu Ile Lys Asn Gln Cys Val Asn Phe Asn  
 515 520 525  
 Phe Asn Gly Leu Thr Gly Thr Gly Val Leu Thr Pro Ser Ser Lys Arg  
 530 535 540  
 Phe Gln Pro Phe Gln Gln Phe Gly Arg Asp Val Ser Asp Phe Thr Asp

545	550	555	560
Ser Val Arg Asp Pro Lys Thr Ser Glu Ile Leu Asp Ile Ser Pro Cys			
565	570	575	
Ser Phe Gly Gly Val Ser Val Ile Thr Pro Gly Thr Asn Ala Ser Ser			
580	585	590	
Glu Val Ala Val Leu Tyr Gln Asp Val Asn Cys Thr Asp Val Ser Thr			
595	600	605	
Ala Ile His Ala Asp Gln Leu Thr Pro Ala Trp Arg Ile Tyr Ser Thr			
610	615	620	
Gly Asn Asn Val Phe Gln Thr Gln Ala Gly Cys Leu Ile Gly Ala Glu			
625	630	635	640
His Val Asp Thr Ser Tyr Glu Cys Asp Ile Pro Ile Gly Ala Gly Ile			
645	650	655	
Cys Ala Ser Tyr His Thr Val Ser Leu Leu Arg Ser Thr Ser Gln Lys			
660	665	670	
Ser Ile Val Ala Tyr Thr Met Ser Leu Gly Ala Asp Ser Ser Ile Ala			
675	680	685	
Tyr Ser Asn Asn Thr Ile Ala Ile Pro Thr Asn Phe Ser Ile Ser Ile			
690	695	700	
Thr Thr Glu Val Met Pro Val Ser Met Ala Lys Thr Ser Val Asp Cys			
705	710	715	720
Asn Met Tyr Ile Cys Gly Asp Ser Thr Glu Cys Ala Asn Leu Leu			
725	730	735	
Gln Tyr Gly Ser Phe Cys Thr Gln Leu Asn Arg Ala Leu Ser Gly Ile			
740	745	750	
Ala Ala Glu Gln Asp Arg Asn Thr Arg Glu Val Phe Ala Gln Val Lys			
755	760	765	
Gln Met Tyr Lys Thr Pro Thr Leu Lys Tyr Phe Gly Gly Phe Asn Phe			
770	775	780	
Ser Gln Ile Leu Pro Asp Pro Leu Lys Pro Thr Lys Arg Ser Phe Ile			
785	790	795	800
Glu Asp Leu Leu Phe Asn Lys Val Thr Leu Ala Asp Ala Gly Phe Met			
805	810	815	
Lys Gln Tyr Gly Glu Cys Leu Gly Asp Ile Asn Ala Arg Asp Leu Ile			
820	825	830	
Cys Ala Gln Lys Phe Asn Gly Leu Thr Val Leu Pro Pro Leu Leu Thr			
835	840	845	
Asp Asp Met Ile Ala Ala Tyr Thr Ala Ala Leu Val Ser Gly Thr Ala			
850	855	860	
Thr Ala Gly Trp Thr Phe Gly Ala Gly Ala Ala Leu Gln Ile Pro Phe			
865	870	875	880
Ala Met Gln Met Ala Tyr Arg Phe Asn Gly Ile Gly Val Thr Gln Asn			
885	890	895	
Val Leu Tyr Glu Asn Gln Lys Gln Ile Ala Asn Gln Phe Asn Lys Ala			
900	905	910	
Ile Ser Gln Ile Gln Glu Ser Leu Thr Thr Ser Thr Ala Leu Gly			
915	920	925	
Lys Leu Gln Asp Val Val Asn Gln Asn Ala Gln Ala Leu Asn Thr Leu			
930	935	940	
Val Lys Gln Leu Ser Ser Asn Phe Gly Ala Ile Ser Ser Val Leu Asn			
945	950	955	960
Asp Ile Leu Ser Arg Leu Asp Lys Val Glu Ala Glu Val Gln Ile Asp			
965	970	975	
Arg Leu Ile Thr Gly Arg Leu Gln Ser Leu Gln Thr Tyr Val Thr Gln			
980	985	990	
Gln Leu Ile Arg Ala Ala Glu Ile Arg Ala Ser Ala Asn Leu Ala Ala			
995	1000	1005	
Thr Lys Met Ser Glu Cys Val Leu Gly Gln Ser Lys Arg Val Asp Phe			
1010	1015	1020	
Cys Gly Lys Gly Tyr His Leu Met Ser Phe Pro Gln Ala Ala Pro His			
1025	1030	1035	1040

Gly Val Val Phe Leu His Val Thr Tyr Val Pro Ser Gln Glu Arg Asn  
           1045                 1050                 1055  
 Phe Thr Thr Ala Pro Ala Ile Cys His Glu Gly Lys Ala Tyr Phe Pro  
           1060                 1065                 1070  
 Arg Glu Gly Val Phe Val Phe Asn Gly Thr Ser Trp Phe Ile Thr Gln  
           1075                 1080                 1085  
 Arg Asn Phe Phe Ser Pro Gln Ile Ile Thr Thr Asp Asn Thr Phe Val  
           1090                 1095                 1100  
 Ser Gly Asn Cys Asp Val Val Ile Gly Ile Ile Asn Asn Thr Val Tyr  
           1105                 1110                 1115                 1120  
 Asp Pro Leu Gln Pro Glu Leu Asp Ser Phe Lys Glu Glu Leu Asp Lys  
           1125                 1130                 1135  
 Tyr Phe Lys Asn His Thr Ser Pro Asp Val Asp Phe Gly Asp Ile Ser  
           1140                 1145                 1150  
 Gly Ile Asn Ala Ser Val Val Asn Ile Gln Lys Glu Ile Asp Arg Leu  
           1155                 1160                 1165  
 Asn Glu Val Ala Lys Asn Leu Asn Glu Ser Leu Ile Asp Leu Gln Glu  
           1170                 1175                 1180  
 Leu Gly Lys Tyr Glu Gln Tyr Ile Lys Trp Pro Trp Tyr Val Trp Leu  
           1185                 1190                 1195                 1200  
 Gly Phe Ile Ala Gly Leu Ile Ala Ile Val Met Val Thr Ile Leu Leu  
           1205                 1210                 1215  
 Cys Cys Met Thr Ser Cys Cys Ser Cys Leu Lys Gly Ala Cys Ser Cys  
           1220                 1225                 1230  
 Gly Ser Cys Cys Lys Phe Asp Glu Asp Asp Ser Glu Pro Val Leu Lys  
           1235                 1240                 1245  
 Gly Val Lys Leu His Tyr Thr  
           1250                 1255

&lt;210&gt; 236

&lt;211&gt; 28

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 236

Asx Thr Thr Met Phe Phe Arg Met Pro Gln Asp Leu Asn Thr Met Leu			
1                       5                       10                         15			
Asn Thr Val Gly Gly His Gln Ala Ala Met Gln Met			
20                      25			

&lt;210&gt; 237

&lt;211&gt; 20

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 237

Pro Gln Asp Leu Asn Thr Met Leu Asn Thr Val Gly Gly His Gln Ala			
1                       5                       10                         15			
Ala Met Gln Met			
20			

&lt;210&gt; 238

&lt;211&gt; 20

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 238

Gly Pro Ile Ala Pro Gly Gln Met Arg Glu Pro Arg Gly Ser Asp Ile

1                   5                   10                   15  
Ala Gly Thr Thr  
20

<210> 239  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 239  
Gly Pro Ile Ala Pro Gly Gln Met Arg Glu Pro Arg Gly Ser Asp Ile  
1                   5                   10                   15  
Ala Gly Thr Thr  
20

<210> 240  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 240  
Lys Gly Cys Trp Lys Cys Gly Lys Glu Gly His Gln Met Lys Asp Cys  
1                   5                   10                   15  
Thr Glu Arg Gln  
20

<210> 241  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 241  
Lys Gly Cys Trp Lys Cys Gly Lys Glu Gly His Gln Met Lys Asp Cys  
1                   5                   10                   15  
Thr Glu Arg Gln  
20

<210> 242  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 242  
His Gln Met Lys Asp Cys Thr Glu Arg Gln Ala Asn Phe Leu Gly Lys  
1                   5                   10                   15  
Ile Trp Pro Ser  
20

<210> 243  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 243  
His Gln Met Lys Asp Cys Thr Glu Arg Gln Ala Asn Phe Leu Gly Lys  
1                   5                   10                   15

Ile Trp Pro Ser  
20

<210> 244  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 244  
His Gln Met Lys Asp Cys Thr Glu Arg Gln Ala Asn Phe Leu Gly Lys  
1 5 10 15  
Ile Trp Pro Ser  
20

<210> 245  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 245  
Ala Thr Leu Glu Glu Met Met Thr Ala Cys Gln Gly Val Gly Gly Pro  
1 5 10 15  
Gly His Lys Ala  
20

<210> 246  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 246  
Ala Thr Leu Glu Glu Met Met Thr Ala Cys Gln Gly Val Gly Gly Pro  
1 5 10 15  
Gly His Lys Ala  
20

<210> 247  
<211> 21  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 247  
Cys Gln Gly Val Gly Gly Pro Gly His Lys Ala Arg Val Leu Ala Glu  
1 5 10 15  
Ala Met Ser Gln Val  
20

<210> 248

<211> 21  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 248  
Cys Gln Gly Val Gly Gly Pro Gly His Lys Ala Arg Val Leu Ala Glu  
1 5 10 15

Ala Met Ser Gln Val  
20

<210> 249  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 249  
Met Phe Ser Ala Leu Ser Glu Gly Ala Thr Pro Gln Asp Leu Asn Thr  
1 5 10 15  
Met Leu Asn Thr  
20

<210> 250  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 250  
Met Phe Ser Ala Leu Ser Glu Gly Ala Thr Pro Gln Asp Leu Asn Thr  
1 5 10 15  
Met Leu Asn Thr  
20

<210> 251  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 251  
Ser Ile Leu Asp Ile Arg Gln Gly Pro Lys Glu Pro Phe Arg Asp Tyr  
1 5 10 15  
Val Asp Arg Phe  
20

<210> 252  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 252  
Ser Ile Leu Asp Ile Arg Gln Gly Pro Lys Glu Pro Phe Arg Asp Tyr  
1 5 10 15  
Val Asp Arg Phe  
20

<210> 253  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 253  
Glu Pro Phe Arg Asp Tyr Val Asp Arg Phe Tyr Lys Thr Leu Arg Ala  
1 5 10 15  
Glu Gln Ala Ser

20

<210> 254  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 254  
Glu Pro Phe Arg Asp Tyr Val Asp Arg Phe Tyr Lys Thr Leu Arg Ala  
1 5 10 15  
Glu Gln Ala Ser  
20

<210> 255  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 255  
Leu Leu Val Gln Asn Ala Asn Pro Asp Cys Lys Thr Ile Leu Lys Ala  
1 5 10 15  
Leu Gly Pro Ala  
20

<210> 256  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 256  
Leu Leu Val Gln Asn Ala Asn Pro Asp Cys Lys Thr Ile Leu Lys Ala  
1 5 10 15  
Leu Gly Pro Ala  
20

<210> 257  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 257  
Lys Thr Ile Leu Lys Ala Leu Gly Pro Ala Ala Thr Leu Glu Glu Met  
1 5 10 15  
Met Thr Ala Cys  
20

<210> 258  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 258  
Lys Thr Ile Leu Lys Ala Leu Gly Pro Ala Ala Thr Leu Glu Glu Met  
1 5 10 15  
Met Thr Ala Cys  
20

<210> 259  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<210> 260  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 260  
Met Gly Ala Arg Ala Ser Val Leu Ser Gly Gly Glu Leu Asp Arg Trp  
1 5 10 15  
Glu Lys Ile Arg  
20

```
<210> 261
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus
```

<400> 261  
Met Gly Ala Arg Ala Ser Val Leu Ser Gly Gly Glu Leu Asp Arg Trp  
1 5 10 15  
Glu Lys Ile Arg  
20

```
<210> 262
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus
```

<400> 262  
 Gly Glu Leu Asp Arg Trp Glu Lys Ile Arg Leu Arg Pro Gly Gly Lys  
   1              5                 10                 15  
 Lys Lys Tyr Lys  
                  20

<210> 263  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 263  
Gly Glu Leu Asp Arg Trp Glu Lys Ile Arg Leu Arg Pro Gly Gly Lys  
1 5 10 15  
Lys Lys Tyr Lys  
20

<210> 264  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 264  
Leu Arg Pro Gly Gly Lys Lys Tyr Lys Leu Lys His Ile Val Trp  
1 5 10 15  
Ala Ser Arg Glu  
20

<210> 265  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 265  
Leu Arg Pro Gly Gly Lys Lys Tyr Lys Leu Lys His Ile Val Trp  
1 5 10 15  
Ala Ser Arg Glu  
20

<210> 266  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 266  
Leu Lys His Ile Val Trp Ala Ser Arg Glu Leu Glu Arg Phe Ala Val  
1 5 10 15  
Asn Pro Gly Leu  
20

<210> 267  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 267  
Leu Lys His Ile Val Trp Ala Ser Arg Glu Leu Glu Arg Phe Ala Val  
1 5 10 15  
Asn Pro Gly Leu  
20

<210> 268  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 268  
Leu Glu Arg Phe Ala Val Asn Pro Gly Leu Leu Glu Thr Ser Glu Gly  
1 5 10 15  
Cys Arg Gln Ile  
20

<210> 269  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 269  
Leu Glu Arg Phe Ala Val Asn Pro Gly Leu Leu Glu Thr Ser Glu Gly  
1 5 10 15  
Cys Arg Gln Ile  
20

<210> 270  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 270  
Leu Glu Thr Ser Glu Gly Cys Arg Gln Ile Leu Gly Gln Leu Gln Pro  
1 5 10 15  
Ser Leu Gln Thr  
20

<210> 271  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 271  
Leu Glu Thr Ser Glu Gly Cys Arg Gln Ile Leu Gly Gln Leu Gln Pro  
1 5 10 15  
Ser Leu Gln Thr  
20

<210> 272  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 272  
Leu Gly Gln Leu Gln Pro Ser Leu Gln Thr Gly Ser Glu Glu Leu Arg  
1 5 10 15  
Ser Leu Tyr Asn  
20

<210> 273  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 273  
Leu Gly Gln Leu Gln Pro Ser Leu Gln Thr Gly Ser Glu Glu Leu Arg  
1 5 10 15  
Ser Leu Tyr Asn  
20

<210> 274  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 274  
Gly Ser Glu Glu Leu Arg Ser Leu Tyr Asn Thr Val Ala Thr Leu Tyr  
1 5 10 15  
Cys Val His Gln  
20

<210> 275  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 275  
Gly Ser Glu Glu Leu Arg Ser Leu Tyr Asn Thr Val Ala Thr Leu Tyr  
1 5 10 15  
Cys Val His Gln  
20

<210> 276  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 276  
Thr Val Ala Thr Leu Tyr Cys Val His Gln Arg Ile Glu Ile Lys Asp  
1 5 10 15  
Thr Lys Glu Ala  
20

<210> 277  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 277  
Thr Val Ala Thr Leu Tyr Cys Val His Gln Arg Ile Glu Ile Lys Asp  
1 5 10 15  
Thr Lys Glu Ala  
20

<210> 278  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 278  
Arg Ile Glu Ile Lys Asp Thr Lys Glu Ala Leu Asp Lys Ile Glu Glu  
1 5 10 15  
Glu Gln Asn Lys  
20

<210> 279

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 279

Arg Ile Glu Ile Lys Asp Thr Lys Glu Ala Leu Asp Lys Ile Glu Glu  
1 5 10 15  
Glu Gln Asn Lys  
20

!

<210> 280

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 280

Leu Asp Lys Ile Glu Glu Glu Gln Asn Lys Ser Lys Lys Lys Ala Gln  
1 5 10 15  
Gln Ala Ala Ala  
20

<210> 281

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 281

Leu Asp Lys Ile Glu Glu Glu Gln Asn Lys Ser Lys Lys Lys Ala Gln  
1 5 10 15  
Gln Ala Ala Ala  
20

<210> 282

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 282

Ser Lys Lys Lys Ala Gln Gln Ala Ala Ala Asp Thr Gly His Ser Asn  
1 5 10 15  
Gln Val Ser Gln  
20

<210> 283

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 283

Ser Lys Lys Lys Ala Gln Gln Ala Ala Ala Asp Thr Gly His Ser Asn  
1 5 10 15  
Gln Val Ser Gln  
20

<210> 284

<211> 20

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 284

Asp	Thr	Gly	His	Ser	Asn	Gln	Val	Ser	Gln	Asn	Tyr	Pro	Ile	Val	Gln
1				5					10					15	
Asn	Ile	Gln	Gly												
				20											

&lt;210&gt; 285

&lt;211&gt; 20

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 285

Asp	Thr	Gly	His	Ser	Asn	Gln	Val	Ser	Gln	Asn	Tyr	Pro	Ile	Val	Gln
1				5					10					15	
Asn	Ile	Gln	Gly												
				20											

&lt;210&gt; 286

&lt;211&gt; 20

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 286

Asn	Tyr	Pro	Ile	Val	Gln	Asn	Ile	Gln	Gly	Gln	Met	Val	His	Gln	Ala
1				5					10					15	
Ile	Ser	Pro	Arg												
				20											

&lt;210&gt; 287

&lt;211&gt; 20

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 287

Asn	Tyr	Pro	Ile	Val	Gln	Asn	Ile	Gln	Gly	Gln	Met	Val	His	Gln	Ala
1				5					10					15	
Ile	Ser	Pro	Arg												
				20											

&lt;210&gt; 288

&lt;211&gt; 20

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 288

Gln	Met	Val	His	Gln	Ala	Ile	Ser	Pro	Arg	Thr	Leu	Asn	Ala	Trp	Val
1				5					10					15	
Lys	Val	Val	Glu												
				20											

&lt;210&gt; 289

&lt;211&gt; 20

&lt;212&gt; PRT

<213> Human Immunodeficiency Virus

<400> 289

Gln	Met	Val	His	Gln	Ala	Ile	Ser	Pro	Arg	Thr	Leu	Asn	Ala	Trp	Val
1				5					10					15	
Lys	Val	Val	Glu												
			20												

<210> 290

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 290

Thr	Leu	Asn	Ala	Trp	Val	Lys	Val	Val	Glu	Glu	Lys	Ala	Phe	Ser	Pro
1				5					10				15		
Glu	Val	Ile	Pro												
			20												

<210> 291

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 291

Thr	Leu	Asn	Ala	Trp	Val	Lys	Val	Val	Glu	Glu	Lys	Ala	Phe	Ser	Pro
1				5					10				15		
Glu	Val	Ile	Pro												
			20												

<210> 292

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 292

Glu	Lys	Ala	Phe	Ser	Pro	Glu	Val	Ile	Pro	Met	Phe	Ser	Ala	Leu	Ser
1					5					10				15	
Glu	Gly	Ala	Thr												
			20												

<210> 293

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 293

Glu	Lys	Ala	Phe	Ser	Pro	Glu	Val	Ile	Pro	Met	Phe	Ser	Ala	Leu	Ser
1					5					10				15	
Glu	Gly	Ala	Thr												
			20												

<210> 294

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 294  
Val Gly Gly His Gln Ala Ala Met Gln Met Leu Lys Glu Thr Ile Asn  
1 5 10 15  
Glu Glu Ala Ala  
20

<210> 295  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 295  
Val Gly Gly His Gln Ala Ala Met Gln Met Leu Lys Glu Thr Ile Asn  
1 5 10 15  
Glu Glu Ala Ala  
20

<210> 296  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 296  
Leu Lys Glu Thr Ile Asn Glu Glu Ala Ala Glu Trp Asp Arg Val His  
1 5 10 15  
Pro Val His Ala  
20

<210> 297  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 297  
Leu Lys Glu Thr Ile Asn Glu Glu Ala Ala Glu Trp Asp Arg Val His  
1 5 10 15  
Pro Val His Ala  
20

<210> 298  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 298  
Glu Trp Asp Arg Val His Pro Val His Ala Gly Pro Ile Ala Pro Gly  
1 5 10 15  
Gln Met Arg Glu  
20

<210> 299  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 299  
Glu Trp Asp Arg Val His Pro Val His Ala Gly Pro Ile Ala Pro Gly  
1 5 10 15  
Gln Met Arg Glu  
20

<210> 300  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 300  
Pro Arg Gly Ser Asp Ile Ala Gly Thr Thr Ser Thr Leu Gln Glu Gln  
1 5 10 15  
Ile Gly Trp Met  
20

<210> 301  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 301  
Pro Arg Gly Ser Asp Ile Ala Gly Thr Thr Ser Thr Leu Gln Glu Gln  
1 5 10 15  
Ile Gly Trp Met  
20

<210> 302  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 302  
Ser Thr Leu Gln Glu Gln Ile Gly Trp Met Thr Asn Asn Pro Pro Ile  
1 5 10 15  
Pro Val Gly Glu  
20

<210> 303  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 303  
Ser Thr Leu Gln Glu Gln Ile Gly Trp Met Thr Asn Asn Pro Pro Ile  
1 5 10 15  
Pro Val Gly Glu  
20

<210> 304  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 304

Thr Asn Asn Pro Pro Ile Pro Val Gly Glu Ile Tyr Lys Arg Trp Ile  
1 5 10 15  
Ile Leu Gly Leu  
20

<210> 305  
<211> 20  
<212> PRT

<213> Human Immunodeficiency Virus

<400> 305  
Thr Asn Asn Pro Pro Ile Pro Val Gly Glu Ile Tyr Lys Arg Trp Ile  
1 5 10 15  
Ile Leu Gly Leu  
20

<210> 306  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 306  
Ile Tyr Lys Arg Trp Ile Ile Leu Gly Leu Asn Lys Ile Val Arg Met  
1 5 10 15  
Tyr Ser Pro Thr  
20

<210> 307  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 307  
Ile Tyr Lys Arg Trp Ile Ile Leu Gly Leu Asn Lys Ile Val Arg Met  
1 5 10 15  
Tyr Ser Pro Thr  
20

<210> 308  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 308  
Asn Lys Ile Val Arg Met Tyr Ser Pro Thr Ser Ile Leu Asp Ile Arg  
1 5 10 15  
Gln Gly Pro Lys  
20

<210> 309  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 309

Asn Lys Ile Val Arg Met Tyr Ser Pro Thr Ser Ile Leu Asp Ile Arg  
1 5 10 15  
Gln Gly Pro Lys  
20

<210> 310  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 310  
Tyr Lys Thr Leu Arg Ala Glu Gln Ala Ser Gln Glu Val Lys Asn Trp  
1 5 10 15  
Met Thr Glu Thr  
20

<210> 311  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 311  
Tyr Lys Thr Leu Arg Ala Glu Gln Ala Ser Gln Glu Val Lys Asn Trp  
1 5 10 15  
Met Thr Glu Thr  
20

<210> 312  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 312  
Gln Glu Val Lys Asn Trp Met Thr Glu Thr Leu Leu Val Gln Asn Ala  
1 5 10 15  
Asn Pro Asp Cys  
20

<210> 313  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 313  
Gln Glu Val Lys Asn Trp Met Thr Glu Thr Leu Leu Val Gln Asn Ala  
1 5 10 15  
Asn Pro Asp Cys  
20

<210> 314  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 314  
Arg Val Leu Ala Glu Ala Met Ser Gln Val Thr Asn Ser Ala Thr

1

5

10

15

<210> 315  
<211> 15  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 315  
Arg Val Leu Ala Glu Ala Met Ser Gln Val Thr Asn Ser Ala Thr  
1 5 10 15

<210> 316  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 316  
Thr Asn Ser Ala Thr Ile Met Met Gln Arg Gly Asn Phe Arg Asn Gln  
1 5 10 15  
Arg Lys Ile Val  
20

<210> 317  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 317  
Thr Asn Ser Ala Thr Ile Met Met Gln Arg Gly Asn Phe Arg Asn Gln  
1 5 10 15  
Arg Lys Ile Val  
20

<210> 318  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 318  
Gly Asn Phe Arg Asn Gln Arg Lys Ile Val Lys Cys Phe Asn Cys Gly  
1 5 10 15  
Lys Glu Gly His  
20

<210> 319  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 319  
Gly Asn Phe Arg Asn Gln Arg Lys Ile Val Lys Cys Phe Asn Cys Gly  
1 5 10 15  
Lys Glu Gly His  
20

<210> 320  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 320  
Lys Cys Phe Asn Cys Gly Lys Glu Gly His Thr Ala Arg Asn Cys Arg  
1 5 10 15  
Ala Pro Arg Lys  
20

<210> 321  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 321  
Lys Cys Phe Asn Cys Gly Lys Glu Gly His Thr Ala Arg Asn Cys Arg  
1 5 10 15  
Ala Pro Arg Lys  
20

<210> 322  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 322  
Thr Ala Arg Asn Cys Arg Ala Pro Arg Lys Lys Gly Cys Trp Lys Cys  
1 5 10 15  
Gly Lys Glu Gly  
20

<210> 323  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 323  
Thr Ala Arg Asn Cys Arg Ala Pro Arg Lys Lys Gly Cys Trp Lys Cys  
1 5 10 15  
Gly Lys Glu Gly  
20

<210> 324  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 324  
Ala Asn Phe Leu Gly Lys Ile Trp Pro Ser Tyr Lys Gly Arg Pro Gly  
1 5 10 15  
Asn Phe Leu Gln  
20

<210> 325

<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 325  
Ala Asn Phe Leu Gly Lys Ile Trp Pro Ser Tyr Lys Gly Arg Pro Gly  
1 5 10 15  
Asn Phe Leu Gln  
20

<210> 326  
<211> 18  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 326  
Tyr Lys Gly Arg Pro Gly Asn Phe Leu Gln Ser Arg Pro Glu Pro Thr  
1 5 10 15  
Ala Pro

<210> 327  
<211> 18  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 327  
Tyr Lys Gly Arg Pro Gly Asn Phe Leu Gln Ser Arg Pro Glu Pro Thr  
1 5 10 15  
Ala Pro

<210> 328  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 328  
Ser Arg Pro Glu Pro Thr Ala Pro Pro Glu Glu Ser Phe Arg Ser Gly  
1 5 10 15  
Val Glu Thr Thr  
20

<210> 329  
<211> 20  
<212> PRT  
<213> Human Immunodeficiency Virus

<400> 329  
Ser Arg Pro Glu Pro Thr Ala Pro Pro Glu Glu Ser Phe Arg Ser Gly  
1 5 10 15  
Val Glu Thr Thr  
20

<210> 330  
<211> 21

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 330

Pro	Glu	Glu	Ser	Phe	Arg	Ser	Gly	Val	Glu	Thr	Thr	Thr	Pro	Pro	Gln					
1									5						10					15
Lys	Gln	Glu	Pro	Ile																
									20											

&lt;210&gt; 331

&lt;211&gt; 21

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 331

Pro	Glu	Glu	Ser	Phe	Arg	Ser	Gly	Val	Glu	Thr	Thr	Thr	Pro	Pro	Gln					
1									5						10					15
Lys	Gln	Glu	Pro	Ile																
									20											

&lt;210&gt; 332

&lt;211&gt; 20

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 332

Thr	Thr	Pro	Pro	Gln	Lys	Gln	Glu	Pro	Ile	Asp	Lys	Glu	Leu	Tyr	Pro					
1									5						10					15
Leu	Thr	Ser	Leu																	
									20											

&lt;210&gt; 333

&lt;211&gt; 20

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 333

Thr	Thr	Pro	Pro	Gln	Lys	Gln	Glu	Pro	Ile	Asp	Lys	Glu	Leu	Tyr	Pro					
1									5						10					15
Leu	Thr	Ser	Leu																	
									20											

&lt;210&gt; 334

&lt;211&gt; 21

&lt;212&gt; PRT

&lt;213&gt; Human Immunodeficiency Virus

&lt;400&gt; 334

Asp	Lys	Glu	Leu	Tyr	Pro	Leu	Thr	Ser	Leu	Arg	Ser	Leu	Phe	Gly	Asn					
1									5						10					15
Asp	Pro	Ser	Ser	Gln																
									20											

&lt;210&gt; 335

&lt;211&gt; 21

&lt;212&gt; PRT

<213> Human Immunodeficiency Virus

<400> 335

Asp	Lys	Glu	Leu	Tyr	Pro	Leu	Thr	Ser	Leu	Arg	Ser	Leu	Phe	Gly	Asn
1					5				10					15	
Asp	Pro	Ser	Ser	Gln											
				20											

<210> 336

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 336

Ala	Thr	Glu	Thr	Leu	Ala	Gly	Ala	Trp	Gly	Asp	Leu	Trp	Glu	Thr	Leu
1					5				10				15		
Arg	Arg	Gly	Gly												
				20											

<210> 337

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 337

Asp	Leu	Trp	Glu	Thr	Leu	Arg	Arg	Gly	Gly	Arg	Trp	Ile	Leu	Ala	Ile
1					5				10				15		
Pro	Arg	Arg	Ile												
				20											

<210> 338

<211> 19

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 338

Arg	Trp	Ile	Leu	Ala	Ile	Pro	Arg	Arg	Ile	Arg	Gln	Gly	Leu	Glu	Leu
1					5				10				15		
Thr	Leu	Leu													

<210> 339

<211> 500

<212> PRT

<213> Human Immunodeficiency Virus

<400> 339

Met	Gly	Ala	Arg	Ala	Ser	Val	Leu	Ser	Gly	Gly	Glu	Leu	Asp	Arg	Trp
1						5			10				15		
Glu	Lys	Ile	Arg	Leu	Arg	Pro	Gly	Gly	Lys	Lys	Lys	Tyr	Lys	Leu	Lys
						20			25			30			
His	Ile	Val	Trp	Ala	Ser	Arg	Glu	Leu	Glu	Arg	Phe	Ala	Val	Asn	Pro
						35			40			45			
Gly	Leu	Leu	Glu	Thr	Ser	Glu	Gly	Cys	Arg	Gln	Ile	Leu	Gly	Gln	Leu
						50			55			60			
Gln	Pro	Ser	Leu	Gln	Thr	Gly	Ser	Glu	Glu	Leu	Arg	Ser	Leu	Tyr	Asn
						65			70			75			80

Thr Val Ala Thr Leu Tyr Cys Val His Gln Arg Ile Glu Ile Lys Asp  
                   85                  90                  95  
 Thr Lys Glu Ala Leu Asp Lys Ile Glu Glu Glu Gln Asn Lys Ser Lys  
                   100              105              110  
 Lys Lys Ala Gln Gln Ala Ala Ala Asp Thr Gly His Ser Asn Gln Val  
                   115              120              125  
 Ser Gln Asn Tyr Pro Ile Val Gln Asn Ile Gln Gly Gln Met Val His  
                   130              135              140  
 Gln Ala Ile Ser Pro Arg Thr Leu Asn Ala Trp Val Lys Val Val Glu  
                   145              150              155              160  
 Glu Lys Ala Phe Ser Pro Glu Val Ile Pro Met Phe Ser Ala Leu Ser  
                   165              170              175  
 Glu Gly Ala Thr Pro Gln Asp Leu Asn Thr Met Leu Asn Thr Val Gly  
                   180              185              190  
 Gly His Gln Ala Ala Met Gln Met Leu Lys Glu Thr Ile Asn Glu Glu  
                   195              200              205  
 Ala Ala Glu Trp Asp Arg Val His Pro Val His Ala Gly Pro Ile Ala  
                   210              215              220  
 Pro Gly Gln Met Arg Glu Pro Arg Gly Ser Asp Ile Ala Gly Thr Thr  
                   225              230              235              240  
 Ser Thr Leu Gln Glu Gln Ile Gly Trp Met Thr Asn Asn Pro Pro Ile  
                   245              250              255  
 Pro Val Gly Glu Ile Tyr Lys Arg Trp Ile Ile Leu Gly Leu Asn Lys  
                   260              265              270  
 Ile Val Arg Met Tyr Ser Pro Thr Ser Ile Leu Asp Ile Arg Gln Gly  
                   275              280              285  
 Pro Lys Glu Pro Phe Arg Asp Tyr Val Asp Arg Phe Tyr Lys Thr Leu  
                   290              295              300  
 Arg Ala Glu Gln Ala Ser Gln Glu Val Lys Asn Trp Met Thr Glu Thr  
                   305              310              315              320  
 Leu Leu Val Gln Asn Ala Asn Pro Asp Cys Lys Thr Ile Leu Lys Ala  
                   325              330              335  
 Leu Gly Pro Ala Ala Thr Leu Glu Glu Met Met Thr Ala Cys Gln Gly  
                   340              345              350  
 Val Gly Pro Gly His Lys Ala Arg Val Leu Ala Glu Ala Met Ser  
                   355              360              365  
 Gln Val Thr Asn Ser Ala Thr Ile Met Met Gln Arg Gly Asn Phe Arg  
                   370              375              380  
 Asn Gln Arg Lys Ile Val Lys Cys Phe Asn Cys Gly Lys Glu Gly His  
                   385              390              395              400  
 Thr Ala Arg Asn Cys Arg Ala Pro Arg Lys Lys Gly Cys Trp Lys Cys  
                   405              410              415  
 Gly Lys Glu Gly His Gln Met Lys Asp Cys Thr Glu Arg Gln Ala Asn  
                   420              425              430  
 Phe Leu Gly Lys Ile Trp Pro Ser Tyr Lys Gly Arg Pro Gly Asn Phe  
                   435              440              445  
 Leu Gln Ser Arg Pro Glu Pro Thr Ala Pro Pro Glu Glu Ser Phe Arg  
                   450              455              460  
 Ser Gly Val Glu Thr Thr Pro Pro Gln Lys Gln Glu Pro Ile Asp  
                   465              470              475              480  
 Lys Glu Leu Tyr Pro Leu Thr Ser Leu Arg Ser Leu Phe Gly Asn Asp  
                   485              490              495  
 Pro Ser Ser Gln  
                   500

&lt;210&gt; 340

&lt;211&gt; 879

&lt;212&gt; PRT

&lt;213&gt; Simian Immunodeficiency Virus

<400> 340  
 Met Gly Cys Leu Gly Asn Gln Leu Leu Ile Ala Ile Leu Leu Ser  
   1               5               10               15  
 Val Tyr Gly Thr Tyr Cys Thr Leu Tyr Val Thr Val Phe Tyr Gly Val  
   20              25              30  
 Pro Ala Trp Arg Asn Ala Thr Ile Pro Leu Phe Cys Ala Thr Lys Asn  
   35              40              45  
 Arg Asp Thr Trp Gly Thr Thr Gln Cys Leu Pro Asp Asn Gly Asp Tyr  
   50              55              60  
 Ser Glu Leu Ala Leu Asn Val Thr Glu Ser Phe Asp Ala Trp Asn Asn  
   65              70              75              80  
 Thr Val Thr Glu Gln Ala Ile Glu Asp Val Trp Gln Leu Phe Glu Thr  
   85              90              95  
 Ser Ile Lys Pro Cys Val Lys Leu Ser Pro Leu Cys Ile Thr Met Arg  
  100             105             110  
 Cys Asn Lys Ser Glu Thr Asp Arg Trp Gly Leu Thr Lys Ser Ile Thr  
  115             120             125  
 Thr Thr Ala Ser Thr Thr Ser Thr Ala Ser Ala Lys Val Asp Met  
  130             135             140  
 Val Asn Glu Thr Ser Ser Cys Ile Ala Gln Asp Asn Cys Thr Gly Leu  
  145             150             155             160  
 Glu Gln Glu Gln Met Ile Ser Cys Lys Phe Asn Met Thr Gly Leu Lys  
  165             170             175  
 Arg Asp Lys Lys Lys Glu Tyr Asn Glu Thr Trp Tyr Ser Ala Asp Leu  
  180             185             190  
 Val Cys Glu Gln Gly Asn Ser Thr Gly Asn Glu Ser Arg Cys Tyr Met  
  195             200             205  
 Asn His Cys Asn Thr Ser Val Ile Gln Glu Ser Cys Asp Lys His Tyr  
  210             215             220  
 Trp Asp Ala Ile Arg Phe Arg Tyr Cys Ala Pro Pro Gly Tyr Ala Leu  
  225             230             235             240  
 Leu Arg Cys Asn Asp Thr Asn Tyr Ser Gly Phe Met Pro Lys Cys Ser  
  245             250             255  
 Lys Val Val Val Ser Ser Cys Thr Arg Met Met Glu Thr Gln Thr Ser  
  260             265             270  
 Thr Trp Phe Gly Phe Asn Gly Thr Arg Ala Glu Asn Arg Thr Tyr Ile  
  275             280             285  
 Tyr Trp His Gly Lys Asp Asn Arg Thr Ile Ile Ser Leu Asn Lys Tyr  
  290             295             300  
 Tyr Asn Leu Thr Ile Lys Cys Arg Arg Pro Gly Asn Lys Thr Val Leu  
  305             310             315             320  
 Pro Val Thr Ile Met Ser Gly Leu Val Phe His Ser Gln Pro Ile Asn  
  325             330             335  
 Asp Arg Pro Lys Gln Ala Trp Cys Trp Phe Gly Gly Lys Trp Lys Asp  
  340             345             350  
 Ala Ile Lys Glu Val Lys Gln Thr Ile Val Lys His Pro Arg Tyr Thr  
  355             360             365  
 Gly Thr Asn Asp Thr Ala Arg Ile Asn Leu Thr Ala Pro Gly Gly Gly  
  370             375             380  
 Asp Pro Glu Val Thr Phe Met Trp Thr Asn Cys Arg Gly Glu Phe Leu  
  385             390             395             400  
 Tyr Cys Lys Met Asn Trp Phe Leu Asn Trp Val Glu Asp Arg Asn Thr  
  405             410             415  
 Thr Asn Gln Lys Pro Lys Glu Gln Tyr Lys Arg Asn Tyr Val Pro Cys  
  420             425             430  
 His Ile Arg Gln Ile Ile Asn Thr Trp His Lys Val Gly Lys Asn Val  
  435             440             445  
 Tyr Leu Pro Pro Arg Glu Gly Asp Leu Thr Cys Asn Ser Thr Val Thr  
  450             455             460  
 Ser Leu Ile Ala Asn Ile Asp Trp Ile Asp Gly Asn Gln Thr Asn Ile  
  465             470             475             480

Thr Met Ser Ala Glu Val Ala Glu Leu Tyr Arg Leu Glu Leu Gly Asp  
485 490 495  
Tyr Lys Leu Val Glu Ile Thr Pro Ile Gly Leu Ala Pro Thr Asn Val  
500 505 510  
Lys Arg Tyr Thr Thr Gly Gly Thr Ser Arg Asn Lys Arg Gly Val Phe  
515 520 525  
Val Leu Gly Phe Leu Gly Phe Leu Ala Thr Ala Gly Ser Ala Met Gly  
530 535 540  
Ala Ala Ser Leu Thr Leu Thr Ala Gln Ser Arg Thr Leu Leu Ala Gly  
545 550 555 560  
Ile Val Gln Gln Gln Gln Leu Leu Asp Val Val Lys Arg Gln Gln  
565 570 575  
Glu Leu Leu Arg Leu Thr Val Trp Gly Thr Lys Asn Leu Gln Thr Arg  
580 585 590  
Val Thr Ala Ile Glu Lys Tyr Leu Lys Asp Gln Ala Gln Leu Asn Ala  
595 600 605  
Trp Gly Cys Ala Phe Arg Gln Val Cys His Thr Thr Val Pro Trp Pro  
610 615 620  
Asn Thr Ser Leu Thr Pro Lys Trp Asp Asn Glu Thr Trp Gln Glu Trp  
625 630 635 640  
Glu Arg Lys Val Asp Phe Leu Glu Glu Asn Ile Thr Ala Leu Pro Glu  
645 650 655  
Glu Ala Gln Ile Gln Gln Glu Lys Asn Met Tyr Glu Leu Gln Lys Leu  
660 665 670  
Asn Ser Trp Asp Val Phe Gly Asn Trp Phe Asp Leu Ala Ser Trp Ile  
675 680 685  
Lys Tyr Ile Gln Tyr Gly Val Tyr Ile Val Val Gly Val Ile Leu Leu  
690 695 700  
Arg Ile Val Ile Tyr Ile Val Gln Met Leu Ala Lys Leu Arg Gln Gly  
705 710 715 720  
Tyr Arg Pro Val Phe Ser Ser Pro Pro Ser Tyr Phe Gln Gln Thr His  
725 730 735  
Ile Gln Gln Asp Pro Ala Leu Pro Thr Arg Glu Gly Lys Glu Gly Asp  
740 745 750  
Gly Gly Glu Gly Asp Gly Asn Ser Ser Trp Pro Trp Gln Ile Glu Tyr  
755 760 765  
Ile His Leu Leu Ile Arg Gln Leu Ile Arg Leu Leu Thr Trp Leu Phe  
770 775 780  
Ser Asn Cys Arg Thr Leu Leu Ser Arg Val Tyr Gln Ile Leu Gln Pro  
785 790 795 800  
Ile Leu Gln Arg Leu Ser Ala Thr Leu Gln Arg Ile Arg Glu Val Leu  
805 810 815  
Arg Thr Glu Leu Thr Tyr Leu Gln Tyr Gly Trp Ser Tyr Phe His Glu  
820 825 830  
Ala Val Gln Ala Ala Trp Arg Ser Ala Thr Glu Thr Leu Ala Gly Ala  
835 840 845  
Trp Gly Asp Leu Trp Glu Thr Leu Arg Arg Gly Gly Arg Trp Ile Leu  
850 855 860  
Ala Ile Pro Arg Arg Ile Arg Gln Gly Leu Glu Leu Thr Leu Leu  
865 870 875